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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **582**

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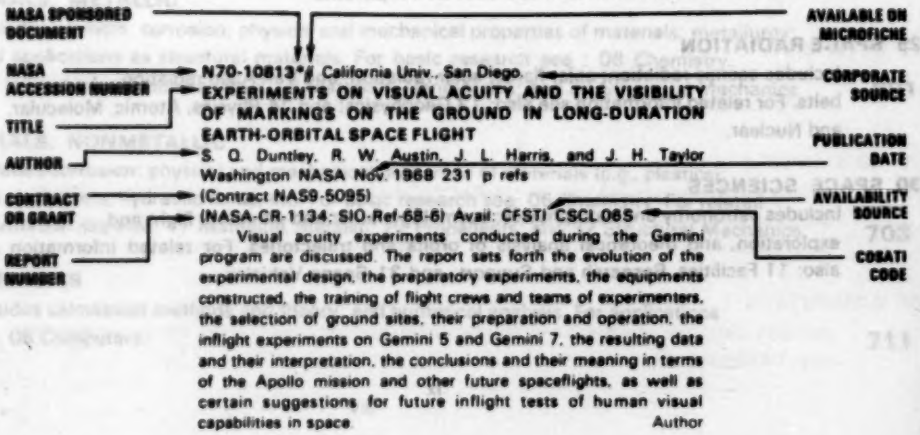
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EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
Washington NASA Nov. 1968 231 p refs
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(Contract NAS9-5095)
AVAILABILITY SOURCE
REPORT NUMBER
(NASA-CR-1134; SIO-Ref-68-6) Avail: CFSTI CSCL 06S
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N70-14134*# Texas A&M Univ., College Station.
TESTS ON PROPELLERS UNDER STATIC THRUST CONDITIONS
J. Brusse, A.E.Cronk, and C. F. Kettleborough Washington NASA Dec. 1969 26 p refs
(Grant NGR-44-001-011)
(NASA-CR-1501) Avail: CFSTI CSCL 01A

Experimental equipment which has been built to measure the performance of a propeller torque, thrust, and flow fields is described. The test data shows that for an activity factor of 100, blade planform at tip speeds ranging from 400 to 900 fps is not a strong parameter in determining gross performance. Author

N70-14163# National Aerospace Lab., Tokyo (Japan).
STALLING CHARACTERISTICS OF THE NACA 0012 AEROFOIL SECTION AT LOW REYNOLDS NUMBERS
Yasuharu Nakamura, Koji Isogai, and Hiroshi Ejiri Jun. 1969 21 p refs In JAPANESE; ENGLISH summary
(NAL-TR-175) Avail: CFSTI

The stalling characteristics of an aerofoil section were investigated experimentally for a range of Reynolds number between 0.3 × 10 to the fifth power and 2.8 × 10 to the fifth power. The data presented include measurements of the chordwise pressure, visual studies of the boundary layer flow, and measurements of the pressure by use of a pressure transducer at a point near the reattachment of the separation bubble. Because of the characteristic extent of the short bubble of about 10% to 20% chord length, the stalling characteristics of the aerofoil section at low Reynolds numbers, although still falling into the category of the leading-edge stall type, are greatly different from those at higher Reynolds numbers. Author

N70-14187*# Kaman Aircraft Corp., Bloomfield, Conn.
THE DYNAMIC BEHAVIOR OF ROTOR ENTRY VEHICLE CONFIGURATIONS. VOLUME 1: EQUATIONS OF MOTION
A. Z. Lemnios and N. Giansante Nov. 1968 38 p refs
(Contract NAS2-3917)
(NASA-CR-73390; R-767-1-Vol-1) Avail: CFSTI CSCL 01A

A theoretical analysis has been conducted to study the dynamic behavior and aerodynamic characteristics of a rotor in autorotative flight operating in proximity of a reentry capsule. A mathematical model representing the rotor entry vehicle was established, the necessary equations formulated and computer programs were generated for solution of this system. The equations of motion describing the articulated rotor blades retained all nonlinear inertial terms and incorporated nonlinear aerodynamics to account for stall, compressibility and reversed flow effects. Provisions were also included to consider the effects on the rotor of the detached bow shock wave generated by the capsule. The equations of motion for vehicle dynamic stability were written to include coupling effects between capsule body motion and rotor forces and moments. Numerical time histories of the coupled rotor entry vehicle system are calculated at time increments specified by the user. Author

N70-14196*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSONIC DYNAMIC AND STATIC STABILITY CHARACTERISTICS OF THREE BLUNT-CONE PLANETARY ENTRY SHAPES
Wayne J. Marko 1 Sep. 1969 35 p refs
(Contract NAS7-100)
(NASA-CR-107405; JPL-TR-32-1357) Avail: CFSTI CSCL 01A

An investigation of the dynamic stability characteristics of three high-drag planetary entry shapes (spherically blunted 60- and 70-deg-half-angle cones) has been conducted in the 6 × 6-ft supersonic wind tunnel at transonic speeds. Free-flight testing techniques were successfully used to document the effects of Mach number and oscillation amplitudes on the transonic dynamic stability of the principal shape, the sharp-edged 60-deg-half-angle cone. Two results were observed. First, transonic dynamic stability coefficients are not as unfavorable (destabilizing) as those previously reported in open literature. However, the decrease in dynamic stability in the transonic regime compared with that in the subsonic and supersonic regimes continues to be significant. Second and most important, the transonic dynamic stability is shown to be dependent on oscillation amplitude. As the effective oscillation amplitude decreased, the dynamic stability became more unfavorable. This effect was observed as highly convergent amplitude envelopes for effective amplitudes greater than 15 deg, and as divergent envelopes for amplitudes below 10 deg. The use of these dynamic stability data in computer simulations of entry into the tenuous atmosphere of Mars by a hypothesized entry capsule is demonstrated. Author

N70-14248# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
HYPERSONIC AERODYNAMIC CHARACTERISTICS OF A FLAT-TOP WING BODY COMBINATION
G. Kamimoto and Y. Uenaka Dec. 1968 34 p refs
(CP-24) Avail: CFSTI

Considerable interest exists today in the development of hypersonic lifting bodies which offers the possibility of rapid long distance travel within the earth's atmosphere. It is desirable to

have a high lift-drag ratio for a vehicle which flies at fairly lower speed than orbital velocity. A brief discussion of available theoretical and empirical results for hypersonic aerodynamic characteristics of delta-winged half cone is given. Author

N70-14278# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TIP LOSSES IN REACTION-TYPE TURBINE CASCADES IN A WIDE RANGE OF ATTACK ANGLES
A. I. Kirillov et al 3 Apr. 1969 10 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 14, no. 1, 1968 p 22–23
(AD-694851; FTD-HT-23-1306-68) Avail: CFSTI CSCL 13/7

Experimental studies were performed of the tip energy losses in three reaction-type turbine shrouded cascades. The blade profiles differed mainly by the leading edge thickness while the trailing edges were practically the same. The flow exit angles for the three tested cascades were 24 degrees, 17 degrees, and 23.5 degrees, respectively. The pitch-chord ratio was practically optimal, and the blade assembly was 120 mm high. The inlet flow angle was varied from 20 to 154 degrees. The effective height of the blades was 105 mm. At high positive angles of attack, the end losses substantially increase. At negative angles of attack, the losses are considered to be approximately equal to those found at rated regimes. The leading edge of the profile practically does not affect the tip losses. Author (TAB)

N70-14546# Army Foreign Science and Technology Center, Washington, D.C.
DESCRIPTION OF INVENTION NUMBER 186 169 STAND FOR TESTING PROPELLERS
K. I. Zhdanov 6 Oct. 1969 8 p Transl. into ENGLISH from Izobret. Prom. Obraztsy, Tovarnye Znaki, (Russian), no. 18, 1966 p 116
(AD-695508; FSTC-HT-23-154-69) Avail: CFSTI CSCL 14/2

The invention describes an improved propeller test stand which utilizes hydraulic pistons installed in the stand to simulate centrifugal and thrust forces, as well as varying aerodynamic loads on the propeller. Author (TAB)

N70-14591# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
MOTION OF A SET OF BANKED WINGS HAVING OPTIMUM DISTRIBUTION OF CIRCULATION WHEN OPERATING NEAR A SOLID GROUND PLANE
P. I. Zinchuk 12 Sep. 1969 9 p refs Transl. into ENGLISH from Gidrodinamika Bolshikh Skorostei, (Russian), no. 3, 1967 p 77–83
(Contract NOW-62-0604)
(AD-695983; APL-CLB-3-T-596) Avail: CFSTI CSCL 1/3

On the basis of the assumptions of Prandtls lifting line theory an integro-differential equation for the optimum distribution of circulation over the span for a system of two wings located a certain distance apart and having the same angle of bank Beta with respect to the ground is derived. An approximate solution of this equation is found and expressions are obtained for the lifting force and pitch-moment coefficients. The results obtained for a practical example (Beta = 15 degrees) are given in graphical form. Author (TAB)

N70-14684# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE FLUTTER OF A CYLINDRICAL SHELL OF ELLIPTICAL CROSS SECTION
L. G. Shandarov 2 May 1969 13 p refs Transl. into ENGLISH FROM Tr. Vses. S'Ezda Teor. Prikl. Mekh., 2nd (Moscow), no. 2, 1968 p 122–126
(AD-694176; FTD-HT-23-42-69) Avail: CFSTI CSCL 1/1

The dynamic stability of an orthotropic elliptic cylinder of finite length in a supersonic gas stream is examined. The coordinate along the axis of the cylinder and the central angle are used as the generalized curvilinear coordinates of the middle surface. The principal radii of curvature and the Lame coefficients are given. The Ritz method is used, and the displacements are sought in the form of double trigonometric series. Each term in the series satisfies all conditions of hinging at the ends. The characteristic equation is studied numerically on an M-20 computer. Author (TAB)

N70-14719# Applied Physics Labs., Johns Hopkins Univ., Silver Spring, Md.
MOTION OF A THIN AIRFOIL AT ARBITRARY DISTANCES FROM A SOLID AND A FLUID BOUNDARY
B. S. Berkovskii et al Aug. 1969 15 p refs Transl. into ENGLISH from Gidrodinam. Bolshikh Korstei (Moscow) no. 1, 1965 p 21–32
(Contract NOW-62-0604)
(AD-695984; APL-CLB-2-T-598) Avail: CFSTI CSCL 1/3

The aerodynamics of lifting systems flying at arbitrary distances from a boundary are discussed. The problem is solved by the kernel degeneration method through reduction of a singular equation of the first kind into a Fredholm equation of the second kind. The coefficients of the system of algebraic equations appearing in the solution of the Fredholm equation can be determined to any degree of accuracy by means of a computer. Author (TAB)

N70-15093 New York Univ., N.Y.
THE NON-PLANAR, MODERATE ASPECT RATIO, SUBSONIC WING
Nicholas R. Rotta (Ph.D. Thesis) 1968 44 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-4576

The general problem of a finite, non-planar wing of arbitrary, smooth, span shape is solved by the method of matched asymptotic expansions. The solution for the spanwise distribution of circulation is presented in the form of an asymptotic series of negative powers and products of powers and logarithms of the aspect ratio. It is found that logarithmic terms (due to curvature) first appear in the second approximation, rather than in the third as in the case of the straight, planar wing. The formulation of the general curved span problem is used to demonstrate that the method of matched asymptotic expansions can be used to analyze a general class of interference problems for non-planar lifting systems of moderate aspect ratio. The method provides the higher order approximations to finite span effects, and therefore presents a solution that accounts for the effects of lower aspect ratio and for the correspondingly higher degree of three-dimensionality associated with the problem of the nonplanar lifting unit. Dissert. Abstr.

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-14186# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LOW-LEVEL ATMOSPHERIC TURBULENCE AFFECTING AIRCRAFT FLIGHT
N. Z. Pinus 26 Mar. 1969 41 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), 1967 p 3–31
(AD-694793; FTD-HT-23-44-69) Avail: CFSTI CSCL 1/1

Atmospheric turbulence acting upon aircraft in the 0-2 km layer of the atmosphere is investigated. The two principal

models of turbulence influencing aircraft, namely turbulence in the form of individual gusts and statistical aggregate of random gusts, are examined with the relevant equations. They include the following formulas: the equation for effective velocity of vertical gusts, the longitudinal and transverse spatial correlation functions, the spatial correlation function for pulsation of the longitudinal component of wind speed, the equation for the energy spectra of the vertical velocity component, the equation for the spectral density, the scale of turbulence, etc. The results of experimental studies are presented. Author (TAB)

N70-14185*# Aztec School of Languages, Inc., Maynard, Mass.
UTILIZATION OF AN AIRCRAFT AS A MEANS OF MEASURING THE STATISTICAL DISTRIBUTION OF TURBULENCE [UTILISATION D'UN AVION COMME MOYEN DE MESURE DE LA DISTRIBUTION STATISTIQUE DE LA TURBULENCE]
G. Coupry and G. Thomasset Washington NASA Dec. 1969 15 p refs Transl. into ENGLISH from French Conf. Paper Presented at the Aeroelastic effects and their influence on the Mech. of Flight, Marseille, 21 – 24 Apr. 1969
(Contract NASw-1692)
(NASA-TT-F-12724) Avail: CFSTI CSCL 01C

The studies presented in this paper were meant to provide a consistent method for using VGH (Velocity, Gravity and Height) recordings, allowing the definition of mass measurements of atmospheric turbulence. This method is based on the calibration of the aircraft regarded as a turbulence measuring instrument, the theoretical methods of prediction being liable to considerable errors. It is shown that careful calibration, carried out on a few flights, makes it possible to measure with great accuracy the statistical distribution of turbulence from center of gravity accelerations. On the other hand, systematic research based on inflight magnetic recording of pilot inputs has led to a technique which takes away, from the total acceleration, the part resulting from the pilot's actions. Author

N70-14234# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
SHORT TAKEOFFS FOR JET AIRCRAFT
N. K. Liseitsev 31 Jan. 1969 16 p refs Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota, (Russian), no. 10, 1967 p 3 – 13
(AD-694913; FTD-HT-23-710-68) CSCL 1/3

For jet aircraft flying at high subsonic and supersonic speeds and fitted with thin wings of small aspect ratio, the most effective way of shortening takeoff distance is to lower the specific load on the wing artificially by deflecting the engine thrust vector. It is assumed that the line of action of the thrust vector always passes through the airplanes center of gravity. To ensure minimum takeoff distance, the thrust-vector rotation must be accomplished when the optimum dynamic head of the particular aircraft has been reached. The climb to the specified obstacle height must be performed without trajectory acceleration. There is a limit to the shortening of takeoff distance that is possible by deflecting the engine thrust vector. Author (TAB)

N70-14256*# Kaman Avidyne, Burlington, Mass.
AUTOMATIC LONGITUDINAL GUIDANCE FOR VTOL AIRCRAFT Interim Scientific Report
William C. Hoffman Oct. 1969 87 p refs
(Contract NAS12-2097)
(NASA-CR-86287; TR-64) Avail: CFSTI CSCL 01C

Development of the automatic guidance modes and associated software for Phase 2 of the V/STOL Avionics Program is evaluated. The initial part of the effort has been restricted to the longitudinal axis of the guidance system. The guidance system controls the position and velocity of the vehicle to satisfy specified flight objectives, e.g. to transport passengers from one airport to another under zero visibility conditions. The guidance system accepts position and velocity information from the navigation system, and generates velocity commands for the flight control system which provides the direct control of the vehicle maneuvers by control displacements. The analytical development of the guidance concept, the simulation employed to evaluate its performance, and the results obtained are given. Author

N70-14264# Weapons Research Establishment, Adelaide (Australia).
FURTHER PERFORMANCE TRIALS OF HIGH ALTITUDE METEOROLOGICAL PARACHUTES
G. J. Simpson Jan. 1969 27 p refs
(WRE-TN-SAD-215) Avail: CFSTI

The concluding trials in the development of a high altitude parachute system for use with a meteorological sonde are described. The results are analyzed for drag and stability performance and effects of wind shear. In the final trial a sonde was lowered from 200,000 ft with an attitude substantially not more than 10 deg away from vertical inclusive of wind shear effects. Author

N70-14347*# AiResearch Mfg. Co., Los Angeles, Calif.
INVESTIGATION AND DEVELOPMENT OF NEW CONCEPTS FOR IMPROVEMENT OF AIRCRAFT ELECTRICAL POWER SYSTEMS Quarterly Progress Report
4 Oct. 1968 62 p refs Revised
(Contract NAS12-659)
(NASA-CR-86281; REPT-68-4176(1)-Rev-1; QPR-1) Avail: CFSTI CSCL 01C

A philosophy is formulated for devising an optimum electrical power system for advanced aircraft, giving particular consideration to improvements in reliability, weight minimization, efficiency, and cost. It has been established that the majority of the power system weight is in the distribution and utilization segments of a typical electrical power system. In addition, it appears that these same areas are the ones in which weight reduction efforts will be most profitable. In the utilization sector, the equipment weight can be substantially reduced by using a higher system frequency. Studies on the generating portion of the system indicate that it will be possible to replace the constant speed drive (CSD) that is presently used with any of several more advanced generating systems. In particular, an attractive alternate is a wild frequency alternator (with wild frequency for the majority of the utilization equipment) with a variable-speed constant frequency (VSCF) system to supply constant voltage-constant frequency power to those loads requiring it. The present CSD units account for about 80 percent of the time and expense involved in servicing all of the generating and distribution equipment. Installation of a VSCF system will eliminate most of this maintenance as well as increasing the reliability of the generating equipment. Author

N70-14608 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
MAIN UNDERCARRIAGE AXLE ULTRASONIC INSPECTION FOR FLAW DETECTION Technical Note
H. Onusic and E. J. Cury 16 May 1969 9 p
(TA-8904.373) Avail: CFSTI

The procedure, equipment and accessories used in the ultrasonic inspection of main carriage axle leg for detection of fracture in Dart – Herald aircrafts operated by Dadia S/A are described. The procedure followed was previously published. A special probe was constructed for the inspection. The results are presented in schematic drawing form, with defect positioning, including photographics of the observed echograms. Author

N70-14823*# AiResearch Mfg. Co., Los Angeles, Calif.
INVESTIGATION AND DEVELOPMENT OF NEW CONCEPTS FOR IMPROVEMENT OF AIRCRAFT

ELECTRICAL POWER SYSTEMS Quarterly Progress Report
22 Nov. 1968 191 p refs
(Contract NAS12-659)
(NASA-CR-86275; QPR-2) Avail: CFSTI CSCL 01C

Current aircraft electrical utilization components are examined. Parametric weight, speed, and power data are presented on power systems with consideration given to induction, brushless, Rice synchronous, and brushless dc motors. Design and performance data for hydraulic and pneumatic systems indicate that hydraulic systems provide better load power for lower weight than electric systems. Electromechanical conversion processes for generating power are described. Conversion techniques for ac and dc power are compared. J.M.C.

N70-14687# Dynamic Science, Phoenix, Ariz. Avser Facility.
CRASH SURVIVAL DESIGN GUIDE
J. W. Turnbow, D. F. Carroll, J. L. Haley, Jr., and S. H. Robertson Ft. Eustis, Va. Army Aviation Mater. Labs. Aug. 1969 297 p refs
(Contract DAAJ02-67-C-0004)
(AD-695648; Avser-69-4; USAAVLABS-TR-70-22) Avail: CFSTI CSCL 1/3

This design guide has been assembled to provide the engineer with an understanding of the basic problems associated with the development of crashworthy U. S. Army aircraft. Where possible, solutions to specific problems are indicated. In other areas in which little design data are available, only the general philosophy appropriate to the problem solution is presented; the details of such solutions as well as the degree of crashworthiness to be achieved must be left, at present, to the ingenuity of the designer. This guide presents in a condensed form the data, design techniques, and criteria which are presently available in eight areas: (1) aircraft crash kinematic and survival envelopes, (2) airframe crashworthiness design criteria, (3) aircraft seat design criteria (crew and troop/passenger), (4) restraint system design criteria (crew, troop/passenger and cargo), (5) occupant environment design criteria, (6) aircraft ancillary equipment stowage design criteria, (7) emergency escape provisions, and (8) postcrash fire design criteria. Author (TAB)

N70-14723# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
FEATURES OF THE PROCESS OF OPTIMIZATION OF HIGH SPEED SOARING FLIGHT
E. P. Vachasov 30 Jan. 1969 12 p refs Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota, (USSR), no. 9, 1967 p 3–8
(AD-693821; FTD-HT-23-852-68) Avail: CFSTI CSCL 1/2

A characteristic of the conditions for optimality of high-speed soaring flight is that, regardless of the nature of the change in the meteorological conditions along the route, the form of their recording remains the same. The optimum procedure at each stage is determined by the characteristics of the external conditions of the present and future and is independent of the past. This makes it possible in all studies of high-speed soaring flight to proceed according to the following principle of optimality. The optimum procedure at each stage of high-speed soaring flight is independent of the natural previous history of movement. A given principle can be applied beginning with any stage. Results which were obtained provide valuable information on the process of optimization of soaring flight, which allow an approximation of each flight to the optimum. Author (TAB)

N70-14825*# Airesearch Mfg. Co., Los Angeles, Calif.
INVESTIGATION AND DEVELOPMENT OF NEW CONCEPTS FOR IMPROVEMENT OF AIRCRAFT ELECTRICAL POWER SYSTEMS Quarterly Progress Report
C. H. Lee 13 May 1969 154 p
(Contract NAS12-659)
(NASA-CR-86276; QPR-3) Avail: CFSTI CSCL 01C

Electrical equipment currently installed in aircraft is described. Power distribution systems are reviewed and characteristics and performance data on cable, circuit breakers, relays and connectors are presented. System control and protection methods are included along with a description of emergency power sources. Current philosophy of displaying information on electrical power systems in commercial transports is outlined. Techniques of cooling aircraft electrical components and possible improvements in heat transfer methods utilizing state-ofthe-art technology are given. Objectives and criteria of aircraft electrical system reliability are discussed. Author

N70-14836# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
ALTIMETER ERRORS
V. I. Ivanov 30 Apr. 1969 11 p Transl. into ENGLISH from Vest. Protivovozdushnoi Oborony, (Russian), no. 9, 1967 p 74–77
(AD-695191; FTD-HT-23-1010-68) Avail: CFSTI CSCL 1/4

The barometric altimeter is essentially a manometer for measuring the static pressure outside an airplane and has three principal errors: (1) the methodical error caused by the deviation of the actual from the standard atmosphere; (2) instrumental error; and (3) error associated with airflow past altimeter air-pressure sensor. The author states that true flight altitude is to be found from the formula given in the text. It is difficult for the pilot to do more than add the instrumental correction; the others are provided by flight control. This requires correction graphs for all planes operating from a given field. Experience has shown that when due allowance is made for errors in barometric altimeter readings these instruments contribute to flight safety. TAB

N70-14913# Naval Postgraduate School, Monterey, Calif.
PRESSURE DISTRIBUTION ON AN AIRFOIL IN OSCILLATING FLOW
Terry Jon Allen (M.S. Thesis) Jun. 1969 76 p refs
(AD-694911) Avail: CFSTI CSCL 1/3

The effect of oscillating flow on the pressure distribution of a symmetrical airfoil was investigated experimentally employing a remote pressure transducer. An open circuit wind tunnel utilizing rotating shutter blades downstream of the test section was used to create oscillating flow. Tests were run at two frequencies, as well as at steady flow, and three angles of attack. The mean and unsteady pressure characteristics were recorded from which mean values of the normal force were determined. The results indicate that an airfoil at high angle of attack will produce more lift in oscillating flow than in steady flow. Author (TAB)

N70-15023*# Dynamics Research Corp., Wilmington, Mass.
OPERATIONAL ALIGNMENT AND CALIBRATION OF THE ISU FOR PHASE 2 OF THE V/STOL PROGRAM. VOLUME 1: CALIBRATION
William H. Fincke Dec. 1969 181 p refs
(Contract NAS12-2150)
(NASA-CR-86302; R-106U-Vol-1) Avail: CFSTI CSCL 01C

This volume presents a detailed design and analysis of a calibration scheme to be used for the strapdown inertial system for Phase 2 of the V/STOL Program. The calibration scheme is capable of being implemented under hanger conditions and runs can be completed within an 8 hour day. The precision of calibration is expected to be sufficient to support flight operations. A total of 11 terms can be determined for each of the 3 gyros and 8 terms for each of the 3 accelerometers. These terms provide the matrix

of misalignments between the ISU body axes and the input axes of each gyro and accelerometer. Second and third order scale factor error coefficients are also estimated as well as bias and gyro g sensitive coefficients. A detailed error analysis of the calibration system was made that provided not only expected calibration estimation precision, but also formed the basis for specifying key performance requirements of the support equipment involved. Consideration was given to designing the system so as to minimize the complexity and number of test equipments required, thereby reducing the cost of implementing the system. Each major support equipment is described functionally. Author

N70-15062# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.
NOISE EXPOSURE FORECAST CONTOUR INTERPRETATIONS OF AIRCRAFT NOISE TRADEOFF STUDIES
Dwight E. Bishop and Richard D. Horonjeff May 1969 46 p refs
(Contract FA-68-WA-1900)
(AD-695507; FAA-NO-69-2) Avail: CFSTI CSCL 20/1

The effectiveness of changes in aircraft operating procedures and aircraft hardware regarding the reduction noise near airports were rated by determining the changes in land areas falling within the Noise Exposure Forecast contours. Sets of NEF contours were constructed for two different aircraft types operating from a single runway airport; the number of operations per day was varied from 200 to 1000. The changes included power cutbacks after takeoff, two segment approaches and retrofit of four-engine turbofan aircraft with acoustically-lined nacelles or with a quiet engine. Author (TAB)

N70-15072# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERONAUTICAL KNOWLEDGE (SELECTED ARTICLES)
Chao-Hua Hu et al 20 Feb. 1969 12 p Transl. into ENGLISH from Hang K'ung Chih Shih (China), v. 2, no. 4, 1965 p 7, 16–17
(AD-693828; FTD-HT-23-403-68) Avail: CFSTI CSCL 1/2

Contents: Some questions concerning application for entrance examination for advanced aeronautical schools; Modification of the rules for model aircraft; and Static testing. TAB

N70-15080*# Intermetrics, Inc., Cambridge, Mass.
LINK GAT-1/PWI OVERALL SIMULATION EXPERIMENT DESIGN
Edward M. Copps and James H. Flanders Dec. 1969 117 p refs
(Contract NAS12-2192)
(NASA-CR-86294) Avail: CFSTI CSCL 01C

The design of a real-time, ground based simulation to evaluate the man-machine problem with a pilot warning indicator (PWI) and other types of hazards or collision avoidance systems is studied. The PWI which is required on all aircraft uses a beacon, sensing, signal processing, warning and display device, and provides: visual and/or aural warning; and relative bearing and elevation if approaching hazard. The general aviation trainer is considered to represent a basic coupling device between the pilot and the aircraft in air traffic, and provides the following encounter geometries: coplanar headon, coplanar from side, coplanar overtaking, ascent from below, and descent from above. These encounters are selected randomly by the simulation controller. F.O.S.

N70-15221*# Research Triangle Inst., Durham, N.C.
STATISTICAL EVALUATION OF AIRCRAFT COLLISION-HAZARD WARNING SYSTEM TECHNIQUES IN THE TERMINAL AREA, PHASE 2
Washington NASA Dec. 1969 283 p refs
(Contract NAS1-7537)
(NASA-CR-1470) Avail: CFSTI CSCL 01C

The rapidly increasing density of air traffic has created a demand for instrumentation to reduce the possibility of air catastrophes due to collision. The incidence of reported near-collisions is now estimated to be over 1000 per year in the United States, and represents a serious threat to the future growth of air travel. For the past year, research has been conducted to develop techniques for evaluation of collision warning systems and to determine the characteristics of the operational environment. Actual aircraft traffic data have been obtained by the FAA from the radar system at the Atlanta Airport. These data have been analyzed to determine encounter statistics which would result with various forms of warning criteria. This report reviews the definition of several proposed warning criteria and presents the results of the statistical analyses of the data. Probabilities of encounter, encounter rates, and average encounter durations are determined for various definitions of the encounter. Author

N70-15224*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A REVIEW OF AERODYNAMIC NOISE FROM PROPELLERS, ROTORS, AND LIFT FANS
Jack E. Marte and Donald W. Kurtz 1 Jan. 1970 54 p refs
(Contract NAS7-100)
(NASA-CR-107568; JPL-TR-32-1462) Avail: CFSTI CSCL 01C

Hand-calculation procedures for predicting aerodynamic noise from propellers, rotors and lift fans useful as first engineering approximations have been assembled from the literature. Considerable introductory material and a glossary of terms has been included to make the prediction procedures more meaningful. Current literature has been reviewed and a comprehensive bibliography on V/STOL aircraft noise is presented. Author

N70-15394*# National Academy of Engineering, Washington, D.C.
CIVIL AVIATION RESEARCH AND DEVELOPMENT: AN ASSESSMENT OF FEDERAL GOVERNMENT INVOLVEMENT
Dec. 1968 36 p refs
(Contract NSR-09-012-912)
(NASA-CR-107573) Avail: Issuing Activity CSCL 01C

The problems of aircraft operations which include transportation problems that relate to the environment of the flight vehicle, the role of man in the operation and maintenance of flight vehicles, the interrelation of certain flight vehicle problems with the traffic system, the limitation of materials, and the interface between the flight environment and that of other systems are discussed. The serious difficulties in the following areas are listed: atmospheric environment, human factors, traffic system, materials, and aircraft-airport interface. It is concluded that NASA could make significant contributions primarily in the following areas: meteorological knowledge and prediction, flight simulation, collision warning and prevention, and aircraft-airport interface. F.O.S.

N70-15443# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE ELEVATED STABILIZED PLATFORM
D. W. Rabenhorst Mar. 1969 29 p refs
(Contract NOw-62-0604-c)
(AD-696060; APL-TG-1067) Avail: CFSTI CSCL 1/3

During recent years the importance of the tethered elevated stabilized platform has been demonstrated by its emergence in several forms in different countries throughout the world. Its chief application has been for enhancement of over-the-horizon surveillance. This report describes a unique Elevated Stabilized Platform (ESP) concept which has few, if any, of the disadvantages of its helicopter predecessor. It has no main gearbox, no rotor blade articulation, and no separate control system, as such. As a matter of fact, in its simplest form it does not have any moving

parts, except for a set of bearings and, of course, the lifting rotors themselves. Although it can maintain a 300 pound payload at 2500 feet altitude, this ESP would not have any subcomponents weighing more than 10 pounds and when in the stowed configuration, its total volume would be of the order of 15 cubic feet. Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-14220*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBINE PERFORMANCE IN A GAS-BEARING BRAYTON CYCLE TURBOALTERNATOR
Joseph S. Curreri, Roman Kruchowy, and James C. Wood Dec. 1969 16 p refs
(NASA-TN-D-5604) Avail: CFSTI CSCL 10A

The performance characteristics of the turbine for a gas-bearing Brayton cycle turboalternator were experimentally determined and compared with design predictions. Design operating conditions were inlet temperature, 1225 F; inlet pressure, 8.45 psia; total-to static-pressure ratio, 1.26; and shaft speed, 12 000 rpm. Performance data were obtained over a range of pressure ratios from 1.1 to 1.4 and at speeds of 10 000, 12 000, and 14 400 rpm. Author

N70-14250*# TRW, Inc., Cleveland, Ohio. Mechanical Products Div.
CARBONATION CELL MATERIALS COMPATIBILITY
N. P. Bannerton, D. L. De Respiris, and J. W. Vogt Washington NASA Dec. 1969 176 p refs
(Contract NAS3-10930)
(NASA-CR-1481) Avail: CFSTI CSCL 10C

A materials test and evaluation program was conducted to investigate the compatibility of selected materials with the alkaline and acid electrolyte environments of stages I, II and III of the TRW carbonation cell system. Stage I and stage II operate at 175 F with a 30 weight percent concentration of potassium carbonate as the electrolyte. The gas compositions are 0.5 percent carbon dioxide with balance of air for stage I and 57 percent carbon dioxide with balance of oxygen for stage II. Stage III operates at 195 F with a 38 weight percent concentration of sulfuric acid as the electrolyte. The gas composition of stage III is 79 percent carbon dioxide with balance of oxygen. Metallic materials and gasket materials were evaluated for compatability with the operating environments of the three stages. Matrix materials were evaluated for the acid electrolyte environment of stage III. Author

N70-14252*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OAO STATE OF CHARGE UNIT
W. Miller, W. Stewart, and J. Yagelowich Jun. 1968 33 p ref
(NASA-TM-X-63757; X-562-68-257) Avail: CFSTI CSCL 10C

The state of charge unit (SOCU) is designed for use as an auxiliary controller of the Orbiting Astronomical Observatory (OAO) battery charge control system. State of charge of the batteries is monitored in ampere-hours by integrating the charge and discharge currents flowing through each of three batteries. The current is monitored by measuring the voltage drops across shunts in the negative lead to each battery. State of charge is also monitored by measurement of the adhydrode potential of one adhydrode (third electrode) cell in each of the three batteries. This report describes the design and instrumentation of this unit. Author

N70-14260*# General Electric Co., Schenectady, N.Y. Mechanical Engineering Lab.
STUDY FOR MAINTENANCE OF HYDRAULIC MOTORS Final Report, 27 Jun. 1967 – 27 Oct. 1968
27 Oct. 1968 207 p refs
(Contract NAS5-10559)
(NASA-CR-99189; S-68-1180) Avail: CFSTI CSCL 13G

Development of methodology and instrumentation for detection and identification of incipient malfunctions in hydraulic components of antenna drives is described. Means for acquisition, processing, and interpretation of diagnostic data are presented. Based on the use of nonintrusive vibration measurements as the means for extracting diagnostic data, analytical studies have predicted the character of normal vibration signatures and the changes to be expected as the result of various defects. The predictions were tested and confirmed in laboratory and field tests, in which it was shown that many defects can be detected without system disassembly before performance has been degraded, thereby securing the advantages of planned maintenance and eliminating unexpected failures. Author

N70-14335*# Northern Research and Engineering Corp., Cambridge, Mass.
ANALYSIS OF GEOMETRY AND DESIGN-POINT PERFORMANCE OF AXIAL-FLOW TURBINES USING SPECIFIED MERIDIONAL VELOCITY GRADIENTS
A. F. Carter and F. K. Lenherr Washington NASA Dec. 1969 240 p refs
(Contract NAS3-12419)
(NASA-CR-1456; NREC-1147-1) Avail: CFSTI CSCL 10A

The report presents the modification of the analysis necessary for a solution using the new analysis variables, documents the resultant computer program, and provides a sample case. The new program complements the original rather than replaces it in that not all the originally selected optional specifications of a design are made available in the new program. However, the program can be used independently of the original for designs in which blade-element performance is directly specified by total-pressure-loss coefficients or indirectly by the coefficients of a correlation of the total-pressure-loss coefficient chosen for fully consistent analyses. Author

N70-14479*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.
RESEARCH, DEVELOPMENT AND FABRICATION OF LITHIUM SOLAR CELLS Quarterly Report
Peter A. Iles 15 Oct. 1969 12 p Prepared for JPL
(Contracts NAS7-100; JPL-952546)
(NASA-CR-107448; QR-1) Avail: CFSTI CSCL 10B

In this quarter, most attention was concentrated on various acceptor sources, and the interaction of these sources with subsequent lithium solar cell properties. It appears possible now to obtain increased output from oxygen-poor silicon, and to provide cells with a gradual transition from earlier cells which used standard BCl3 processes. The shipments scheduled and much of the work for the next period will continue the emphasis of the present period. Author

N70-14484*# Exotech, Inc., Washington, D.C.
SOLAR CELL PERFORMANCE MATHEMATICAL MODEL Quarterly Report
M. J. Barrett and M. B. Hornstein 15 Dec. 1969 24 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952548)

(NASA-CR-107437; TRSR-70-06; QR-2) Avail: CFSTI CSCL 10B

Preparation of a computer program for silicon solar cell performance in the space environment is reported. The previously completed mathematical model has been reviewed in the light of current research activity and improvements to the model are suggested. Numerical and graphic results of computations are provided. Author

N70-14554# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.

QUALITY ASSURANCE PROGRAM FOR ZINC ANODE-ELECTROLYTE COMPOSITES

David M. Sague and David Linden Aug. 1969 19 p refs

(AD-695610; ECOM-3162) Avail: CFSTI CSCL 10/3

A quality assurance program was established covering quality control, evaluation, and acceptance procedures to assure the required quality level and performance of the anode electrolyte composite for the mechanically rechargeable zinc-air battery. The report presents the details of this quality assurance program and presents data showing its success in upgrading the quality and performance of composites manufactured by two suppliers. Other benefits of the program in detecting changes in manufacturing procedures or design and indicating direction for further improvement are presented. Author (TAB)

N70-14573# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.

MAINTENANCE-FREE LEAD ACID BATTERIES

Otto C. Wagner Aug. 1969 21 p refs

(AD-695626; ECOM-3168) Avail: CFSTI CSCL 10/3

An evaluation program on maintenance-free lead-acid batteries was conducted at the US Army Electronics Command for the purpose of determining the feasibility of replacing some of the more expensive nickel-cadmium batteries in the field. With the elimination of troublesome water makeup along with the employment of new state-of-the-art electrode designs, which feature long life and efficient high rate discharge capabilities, the familiar lead-acid battery has become attractive as a high capacity, long life battery with low user cost. Environmental testing has been completed. This battery, with lead-calcium grids, will retain 70% of its initial capacity after storage at 125F for 30 days. A cycle life of 200 cycles at 80% depth of discharge was demonstrated, no water makeup being required during cycling. Author (TAB)

N70-14709*# Eagle-Picher Co., Joplin, Mo. Couples Dept.

HEAT-STERILIZABLE, REMOTELY ACTIVATED BATTERY DEVELOPMENT PROGRAM, PHASE 2 Quarterly Report, 1 Jul. - 30 Sep. 1969

25 Oct. 1969 30 p Prepared for JPL

(Contracts NAS7-100; JPL-952214)

(NASA-CR-107433; QR-5) Avail: CFSTI CSCL 10C

This report discusses the progress during the development of a heat sterilizable, sealed, remotely activated battery. A brief cell study was conducted to determine the most efficient design for the requirements. The tests consisted of separator studies with wet stand life and discharge rates as test parameters. Determinations are based on the 10 and 24 minute discharge rates. Ignitors were proven capable of heat sterilization. The results show that the ignitors will function with a reliability of 0.997. Components for the initial prototype battery have been fabricated or procured. Author

N70-14830*# Electro-Optical Systems, Inc., Pasadena, Calif. Aerospace Systems Div.

COMPUTER PROGRAM FOR PLANETARY SOLAR ARRAY DEVELOPMENT Summary Report

10 Nov. 1969 84 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952608)

(NASA-CR-107436; EOS-4042-SR) Avail: CFSTI CSCL 10A

A computer program that will print the power output of a solar panel located arbitrarily on the surface of Mars is described. The modifications provide for solar cell model input in terms of 200 (or fewer) points describing the room-temperature I-V characteristics, and up to 25 points for each temperature coefficient; add a subroutine to define the attenuation and scattering as a result of atmospheric dust, including layering on the panel; print out important cell I-V values during three periods of the Martian day; and perform a brief study of the sand dune height expected on Mars. Theoretical calculations of Rayleigh and Mie scattering are derived. The program is included; it is written in Fortran 4 for an XDS Sigma 7 computer. Instructions are given to prepare the set of necessary input parameters; an explanation and sample printout are included. Author

N70-14933# Stanford Univ., Calif. Plasma Physics Lab.

EFFECTS OF ELECTRODE SIZE ON THE PERFORMANCE OF A COMBUSTION DRIVEN MHD GENERATOR Technical Report Jul. 1966 - Jul. 1969

Edward Stephen Rubin Aug. 1969 151 p refs

(Contract F33615-67-C-1127)

(AD-694039; AFAPL-TR-69-72) Avail: CFSTI CSCL 10/2

A single molybdenum electrode pair, shielded from end effects by two additional electrode pairs, was located at the downstream end of an MHD channel. Two types of experiments were performed. First, the effects of electrode size on performance was examined at electrode temperatures between 530K and 1600K for a fixed channel geometry, combustion gas mass flow rate, magnetic field strength, and upstream wall temperature (2200K). Three electrode sizes were used (length-to-pitch ratios of 0.2, 0.5, and 0.8), and performance was evaluated directly from electrode voltage drops determined as a function of current. The second type of experiment investigated electrode size effects in the presence of dissimilar boundary layer conductivities, reflecting coupling between electrode and gas boundary layer temperatures in a cold-electrode generator. A hot wall was used upstream of small electrodes and a cold (750K) wall upstream of large electrodes. For similar conditions of surface and gas boundary layer temperature, larger electrodes were found to yield lower voltage losses at a given load current. However, for dissimilar boundary layers, total voltage losses for a large electrode pair were equal to or greater than those of a small electrode pair at the same surface temperature. Author (TAB)

N70-14977# Naval Postgraduate School, Monterey, Calif.

MOLECULAR-ION ELECTROGASDYNAMIC FLOW CHANNEL

David William Wallace (M.S. Thesis) Jun. 1969 53 p refs

(AD-694915) Avail: CFSTI CSCL 10/2

This investigation evaluates the operating characteristics of an EGD (electrogasdynamic) generator system which utilizes air both as the carrier fluid and as the source of injected ions. The design and construction of a flow channel and a corona ion injector are discussed, the performance of the ion injector is examined, and the results of attempts to obtain work by EGD energy conversion are presented. The experimental results presented and discussed are in reasonable agreement with expectations. The high mobility of molecular ions inhibits the conversion process and only 0.5% of the ions were removed from the corona by the air flow. Suggestions for improvements on the present system and the design of an advanced system are made. Author (TAB)

N70-15005# Naval Postgraduate School, Monterey, Calif.

ION INJECTORS FOR SINGLE-PHASE AND TWO-PHASE ELECTROGASDYNAMIC GENERATORS

William Taylor Ober, II (M.S. Thesis) Jun. 1969 47 p refs
(AD-694906) Avail: CFSTI CSCL 10/2

Systems suitable for the injection of ions into electrogasdynamic (EGD) generator devices were built and tested. The mechanism of injection was based on a corona discharge, whereby ions moving through an electric field can be intercepted by a gaseous flow. The intercepted ions are of one polarity, insuring selective ion injection. Two types of injector units were investigated. One was a molecular ion device which produced ions directly from the carrier gas, and the other created larger sized ions, resulting in an aerosol flow. The latter consisted of passing saturated steam through a corona discharge and injecting it into an air stream. In order to aid the injection process, the wake of a cylinder in the air stream was utilized in both cases. Most of the work done here was devoted to the design and testing of the aerosol flow device. The degree of success was moderate.
Author (TAB)

N70-15014# Army Electronics Command, Fort Monmouth, N.J.
STATIC INVERTER FOR LIGHTWEIGHT, SILENT DC-AC FIELD POWER SOURCE
William L. Dudley Sep. 1969 20 p refs
(Contract DA-1-T-662705A-053)
(AD-695652; ECOM-3171) Avail: CFSTI CSCL 10/2

A static inverter for a portable, silent, military power source providing 120 volt, 60 and 400 Hz a.c. and 24 volt d.c. power is described. Sinusoidal a.c. voltage is processed by a high frequency static inverter from a mechanically rechargeable metal air battery d.c. power source. The battery and inverter manpack modules, weighing 35 and 30 pounds, respectively, supply 500 VA continuously for 5 hours per anode charge. Author (TAB)

N70-15402*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: GENERAL PERFORMANCE TEST OF GENERAL ELECTRIC 20 AMPERE-HOUR NICKEL-CADMIUM SECONDARY SPACECRAFT CELLS
Donald E. Christy 24 Nov. 1969 39 p
(Contract NASw-12397)
(NASA-CR-107564; QE/C-69-988) Avail: CFSTI CSCL 10B

To gather specific information concerning sealed nickel-cadmium cells designed for use in spacecraft, the cells were subjected to environmental tests of vibration, mechanical shock, and acceleration. Charge and discharge characteristics are tabulated, and the results of general performance tests are graphed. F.O.S.

N70-15481*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: EVALUATION OF STORAGE METHODS, OPEN CIRCUIT VERSUS CONTINUOUS TRICKLE CHARGE, SONOTONE 3.5 AMPERE-HOUR SEALED NICKEL-CADMIUM SECONDARY SPACECRAFT CELLS
D. E. Christy 5 Nov. 1969 30 p
(NASA Order W-12397)
(NASA-CR-107575; QE/C-69-869) Avail: CFSTI CSCL 10C

A comparison of the discharge and charge characteristics of charged cells on open circuit versus that of cells on continuous trickle charge is presented for the third successive year of storage. It is concluded that: (1) The initial capacities of charged cells following the first, second and third one-year open circuit periods are unreliable. (2) The initial capacities of charged cells following the first, second and third one-year trickle charge storage periods are reliable. (3) The second and third discharge capacities of cells following successive yearly open circuit storage periods are reliable, and averaged considerably higher than the capacities of cells following the first two years of trickle charge storage. F.O.S.

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-14105# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DIFFERENTIAL DC AMPLIFIER WITH VERY HIGH INPUT IMPEDANCE
Chun-Chiang Ch'en et al 21 May 1969 17 p refs Transl. into ENGLISH from Tien Tzu Hsueh Pao (Peking), no. 2, 1966 p 176–184
(AD-694881; FTD-HT-23-1163-68) Avail: CFSTI CSCL 6/2

A new differential d-c amplifier was designed to be used in conjunction with microelectrode techniques to record the electrical activity of a single biological cell. The differential d-c amplifier consists of a differential cascade and a negative feedback circuit. Specifications of the amplifier are given. The new amplifier has high anti-interference ability, and has been extensively used in a biological laboratory for more than 3 years. Operating experience shows the new amplifier has excellent performance and high stability and is easy to operate. TAB

N70-14152*+ New Mexico Univ., Albuquerque.
AN IMPROVED TECHNIQUE FOR MICROBIOLOGICAL SAMPLING OF SURFACES: AGAR SPRAY
F. W. Oswalt, L. W. Hughes, M. E. Morris, and J. W. Beakley Sep. 1968 12 p Prepared jointly with Sandia Corp.
(Grant NGR-09-019-040)
(NASA-CR-107357; PB-182177; SC-RR-68-593) Avail: CFSTI CSCL 06M

This report describes an improved technique for biological sampling of surfaces. While previous approaches have been limited to the removal of the microorganisms from the surfaces, the technique described herein deletes this often questionable operation and initiates growth and enumeration of the organisms in situ, i.e., without removing them from the surface. The method employs spraying molten (53 degrees C) agar media directly onto the surface to be sampled and incubating the microorganisms thereon. A description of the spray apparatus with drawings is provided. Test results and advantages of the technique are presented.
Author (USGRDR)

N70-14182# Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares.
INTERNAL ACCUMULATION AND RETENTION OF CS-137 BY CARASSIUS AURATUS L. [ACUMULACAO E RETENCAO DO CS-137 POR CARASSIUS AURATUS L EM CORPO INTEIRO]
Maria Carolina Vaz Carreiro 1969 22 p refs In PORTUGUESE *Its* Nota Interna no. 39
Avail: CFSTI

The accumulation and retention of Cs-137 in the body was studied using the fresh water species Carrassius auratus L. in laboratory experiments. The accumulation resulted from the direct assimilation of the Cs-137 from water solution. The results indicate two biological periods of retention, one of 0.66 days and the other 16.74 days. Transl. by F.O.S.

N70-14183# Junta de Energia Nuclear, Sacavem (Portugal). Lab. de Fisica e Engenharia Nucleares.
ABSORPTION OF CS-137 BY SPONDYLIOSOMA CANTHARUS L. [ABSORCAO DO CS-137 POR SPONDYLIOSOMA CANTHARUS L.]
Maria Carolina Vaz Carreiro 1969 21 p refs In PORTUGUESE

Its Nota Interna no. 40
Avail: CFSTI

The metabolism of Cs-137 is studied in the edible species, Spondyliosoma cantharus L., of the Tejo River estuary. The purpose of this research was to determine the concentration of Cs-137 in the organs and tissues. Results are summarized in graphs showing the concentration factor plotted against time for various organs of the Spondyliosoma. Transl. by F.O.S.

N70-14256*# Techtran Corp., Glen Burnie, Md.
THE FUNCTIONAL STATE OF THE KIDNEYS IN WORKERS EXPOSED TO THE PROLONGED ACTION OF CHLORORGANIC CHEMICAL POISONS [FUNKTSIONALNOYE SOSTOYANIYE POCHEK U RABOTAYUSHCHIKH V USLOVIYOKH DLITELNOGO VOZDEYSTVIYA KHLORORGANICHESKIKH YADOKHIMIKATOVIN VRACHEBNOYE DELO]
N. G. Loganovskiy Washington NASA Dec. 1969 8 p Transl. into ENGLISH from Russian report
(Contract NASw-1695)
(NASA-TT-F-12669) Avail: CFSTI CSCL 06P

A study of 106 persons suspected of chronic intoxication with chlororganic chemical poisons, DDT, benzene hexachloride, ethersulphonate (ovotran), revealed that prolonged contact with the mentioned substances led to more or less distinct disorders of the renal functional capacity, the renal plasma flow being disturbed first. These renal disorders may be caused by direct effect of chlororganic substances on the kidneys and through their toxic effect on other organs and systems like the central nervous system, cardiovascular and endocrine systems, liver. Author

N70-14283*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
IONIZING RADIATION AND MAGNETIC FIELDS: A REVIEW OF THEIR EFFECTS ON THE NERVOUS SYSTEM
H. L. Galiana Feb. 1969 30 p refs
(Grant NGR-22-009-312)
(NASA-CR-107358; MVLS-69-1) Avail: CFSTI CSCL 06D

Data on the functional sensitivity of the nervous system to ionizing radiation and magnetic fields suggest caution in prolonged human exposure to similar environments. Unfortunately, the conditions investigated are also characteristic of those expected during a space flight. Studies are thus needed to determine the nature and mechanism(s) of the nervous system's reactions to these and other factors, and to investigate the degree to which the astronaut's performance capabilities may be affected. Such knowledge would also prove helpful in determining protection standards for occupationally exposed personnel and in medical research. Author

N70-14282*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, OCTOBER 1969
Nov. 1969 123 p refs
(NASA-SP-7011(69)) Avail: CFSTI CSCL 06C

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N70-14314# California Univ., Livermore. Lawrence Radiation Lab.
ESTIMATION OF INHALED PARTICLE SIZE OF PuO SUB 2-239 BASED ON THE NEW LUNG MODEL AND BIOASSAY RESULTS
D. S. Myers *In its* Hazards Control Dec. 1968 p 17-20 Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

A technique is presented to estimate the aerodynamic particle size of inhaled Pu-239O2 from bioassay results by relating initial gastrointestinal tract clearance (days 1 and 2) to late gastrointestinal tract clearance (2 weeks after exposure). This technique is based on theoretical considerations of the new lung model. Author (NSA)

N70-14330# School of Aerospace Medicine, Brooks AFB, Tex.
REPRODUCIBILITY OF REPEATED TOTAL BODY WATER MEASUREMENTS WITH TRITIUM Final Report, Aug. 1968-Jan. 1969
Donald F. Logsdon, Jr., James F. Green, and John W. Harper Jul. 1969 13 p refs
(AD-695786; SAM-TR-69-36) Avail: CFSTI CSCL 6/18

The reproducibility of repeated measurements of total body water (TBW) in the same individual, by means of an isotope technic, was dependent on the percentage clearance of the isotope per week and the interval between determinations. Sudies of six normal subjects, with percentage clearances ranging from 41% to 80% per week, showed that a sample-to-background counting rate ratio of at least 2:1 was necessary to obtain reproducible values. The variance was found to be about 1%, or plus or minus 0.5 liter. The 2-week interval was the minimal time interval which gave reproducible values for individuals having a percentage clearance within normal limits (45% to 95%). Author (TAB)

N70-14331# School of Aerospace Medicine, Brooks AFB, Tex.
SEASONAL ADRENOCORTICAL TRENDS FOR MILITARY TRAINEES IN A SUBTROPICAL CLIMATE Final Report, Jun. 1963-Jun. 1965
Ira L. Shannon and Henry B. Hale Aug. 1969 14 p refs
(AD-695788; SAM-TR-69-43) Avail: CFSTI CSCL 6/18

Air Force recruits who were undergoing basic training at Lackland Air Force Base, Tex., were studied for evidence of climate-related adrenocortical change. The study was run over a 52-week period, with a different group of 10 or 11 trainees under study each week. Serum 17-OHCS determinations were made at 0730, 1130, and 1530 hours, with the subjects fasting, inactive, and at thermoneutrality. Urinary 17-OHCS measurements were carried out on 4-hour urine specimens collected at 1130 and 1530 hours. The seasonal variation found for serum 17-OHCS was statistically significant, but that found for urinary 17-OHCS was not. The patterns of variation over the seasons for serum 17-OHCS were not the same at different times of day ($P < .005$). The serum 17-OHCS data obtained at 0730 hours most distinctly indicated (a) equality for the winter and autumn groups, (b) mild adrenocortical hyperactivity for the spring group, and (c) mild adrenocortical hypoactivity for the summer group. Author (TAB)

N70-14356# Trinity Univ., San Antonio, Tex. Dept. of Biology.
DIFFERENTIAL EFFECTS OF LIGHT ON PHOTOSYNTHESIS AND NITROGEN METABOLISM IN CHLORELLA PYRENOIDOSA Final Report, Dec. 1965-Dec. 1967
Howell D. Cobb, Richard H. Hall, and Walter J. Costello Jul. 1969 16 p refs
(Contract AF 41(609)-3004)
(AD-695787; SAM-TR-69-40) Avail: CFSTI CSCL 6/3

A series of investigations was conducted to examine some of the differential effects of light on the photosynthetic reduction of carbon dioxide and on nitrogen metabolism in the unicellular alga, Chlorella pyrenoidosa. Nitrite uptake in the presence of, and in the absence of, carbon dioxide was measured. Similar

measurements were made of nitrate uptake. Light intensities above the saturation level for photosynthesis reduced the rate of nitrite uptake but did not appear to affect the uptake of either carbon dioxide or nitrate. The rate of nitrite uptake at 20 mw./sq. cm. was approximately 50% of that at 8 mw./sq. cm., while over this same range of intensities the uptake of carbon dioxide and nitrate remained constant. At light intensities below the saturation level for photosynthesis, nitrate appeared to compete with carbon dioxide for light energy. In short-term experiments the assimilatory CO2/NO3 ratio at 0.50 mw./sq. cm. was one-third that observed at 8 mw./sq. cm., indicating that under these conditions nitrate uptake had priority over carbon dioxide assimilation. Author (TAB)

N70-14358# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Division

RADIATION INJURIES AND COMPENSATION OF DISTURBED FUNCTIONS

Yu. G. Grigorev 6 May 1969 198 p refs Transl. into ENGLISH from Luchevye Porzheniya i Kompensatsiya Narushennykh Funktsii (Moscow), 1963 p 1–203
(AD-695899; FTD-MT-24-323-68) Avail: CFSTI CSCL 6/18

The results of extensive clinical and experimental research on systemic reactions of the organism during exposure to radiation is presented. The investigations include: the biological effect of small radiation doses as manifested in the initial reactions of the nervous system, functional reactions of the organism during irradiation with lethal doses, and special aspects of death in animals due to radiation. New methodological procedures used in the investigations are described. Problems of the compensation by the organism of functions disrupted by radiation injury are examined and the various compensatory reactions classified. Further experiments designed to explore the capacities of the organism for compensating radiation injuries are reported. Author (TAB)

N70-14411# Joint Publications Research Service, Washington, D.C.

RADIOTELEMETRY IN ANIMAL ECOLOGY: RADIO TRACKING OF ANIMALS

V. Ye. Sokolov et al 25 Nov. 1969 25 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 47, no. 1, Jan. 1968 p 20–35
(JPRS-49316) Avail: CFSTI

A review of foreign studies using radiogoniometry in animal tracking is presented. Radio tracking systems for animals are analyzed. Methods of fastening goniometric transmitters on animals are described. Recommendations are given on the elaboration of elements and systems for radio tracking animals, as well as methods for calculating technical characteristics of radiolines and evaluation of their efficiency under various natural conditions. Author

N70-14442# Brookhaven National Lab., Upton, N.Y. Medical Research Center.

THE MEDICAL USE OF CALIFORNIUM-252

Harold L. Atkins *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 285–302 refs Sponsored by AEC (See N70-14429 04-24)
(BNL-12919) Avail: CFSTI

The development of encapsulated sources of Cf-252 suitable for interstitial application has provided a versatile tool for tumor therapy. These implantable sources are especially useful for certain applications, and have definite advantages over other sources of neutrons. The required amounts of Cf-252 are so small that the material can be electrodeposited on a very thin wire so that extreme flexibility in source design is possible. Some of the advantages of the Cf-252 source include: cost, reliability, facilities and personnel required, and the existence of a higher LET and presumably lower OER than neutrons produced by accelerator reactions. Before a therapeutic trial with Cf-252 it will be necessary to determine the following: the RBE for this form of irradiation compared to more conventional forms, the effects of protracted versus acute irradiation, the tolerance dose for normal tissues, and the OER. Because of the need for implantation of the Cf-252 source, only those tumors which are accessible can be considered for irradiation. NSA

N70-14550# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

METHOD FOR EVALUATING THE ABSORBED POPULATION DOSAGES IN CASE OF A NUCLEAR ACCIDENT [METODI DI VALUTAZIONE DELLE DOSI ASSORBITE DA UNA POPOLAZIONE IN CASO DI INCIDENTE IN UN IMPIANTO NUCLEARE]

A. Cardinale and A. Nardi 17 Jan. 1969 32 p refs In ITALIAN (RT/PROT(69)-17) Avail: CFSTI

Doses and reference levels to be used for evaluating the situations from nuclear accidents are calculated. In such situations, the risk due to the accident is evaluated and compared with the consequences of eventual radio-logical protection measures. The following subjects are considered: (1) fundamental and derived reference limits, and (2) irradiation, ingestion, inhalation and submersion risks. Author

N70-14583*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

PATTERN CLASSIFICATION APPLIED TO ELECTRO-ENCEPHALOGRAPHS

J. L. Poage and K. P. S. Prabhu Sep. 1969 60 p refs (Grant NGR-22-007-143)
(NASA-CR-107449; TR-1) Avail: CFSTI CSCL 06L

Pattern classification techniques are employed to classify an electro-encephalograph (EEG) record into two parts—one part containing evoked responses to photic stimuli and the other part not containing such evoked responses. A feature reduction method is suggested to decrease the amount of data to be handled in the context of linear classificatory procedures. A sequential algorithm is presented to classify unknown samples into one of two linearly inseparable classes. The algorithm is formed from training sets of known classification. An estimate (on an expected value basis) of the probability of making an error classification is given. Author

N70-14590# Human Engineering Labs., Aberdeen Proving Ground, Md.

NIGHT VISION WITH A BINOCULAR SYSTEM

Robert W. Bauer and David J. Florip Aug. 1969 17 p refs (AD-695637; TN-3-69) Avail: CFSTI CSCL 17/8

Recovery of dark adapted acuity after the use of a night vision system was observed in two experiments within a flight simulation facility. The users of these two systems gave up about one log cycle in dark adaptation (luminance required) to gain about one log cycle in viewing objects 5 to 10 minutes or larger. One hundred percent recovery of rod dark adaptation required from 3.0 to 4.2 minutes. Because of their target brightness sensitivity, color characteristics and acuity ranges, these systems can be appropriately compared with human unaided dark adapted rod vision. Author (TAB)

N70-14661*# National Aeronautics and Space Administration, Washington, D.C.

THE INTERACTION OF LIVING SYSTEMS WITH THE SPACE ENVIRONMENT

Joseph F. Saunders *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 195–215 (See N70-14651 04-15)
Avail: CFSTI CSCL 06C

Biosatellite experiments described sought to determine the effects of weightlessness alone as well as the combined effects of radiation and weightlessness on plants, bacteria, and animals. It was found that weightlessness altered the orientation as well as the

growth of plants. Bacteria, insects, and plants exposed to gamma radiation while weightless confirmed that neutralization of gravity does change the effects of radiation on the cellular elements that control heredity; greater damage occurred to unpaired chromosomes such as the "X" or male chromosome. A primate showed physiologic deterioration attributed mainly to weightlessness. Changes occurred in central nervous systems function, cardiovascular performance, fluid and electrolytic metabolism, and circadian rhythms. Positive effects of space flight were observed in cell division and differentiation, growth and development, chromosome aberrations and mechanics, mutation, biochemical interaction, and decrement physiological function in organs and systems. Author

N70-14662*# General Electric Co., Philadelphia, Pa.
UNIT SEPARATION PROCESSES IN SPACE
L. R. Mc Creight and R. N. Griffin *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 216–237 refs (See N70-14651 04-15)
(Contract NAS8-24683)
Avail: CFSTI CSCL 06E

Some unit separation processes used for purifying chemicals and biologicals (vaccines) are clearly affected by the earth's gravity and therefore might be improved by operation in space. Centrifugation and electrophoresis are the prime examples of such processes. Meanwhile other processes such as freeze drying and ultraviolet sterilization are desirable adjuncts in a spectrum of processes that could permit the complete preparation of vaccine or other materials in space. The freeze drying operation would take advantage of the low temperatures and vacuum of space. These processes are being considered as interrelated processes that could lead to the complete preparation of vaccine or to the preparation of materials to be used in other processes and products. Author

N70-14663*# Martin Marietta Corp., Denver, Colo.
INDUSTRIAL MICROBIOLOGICAL APPLICATIONS IN ZERO GRAVITY A VACCINE SATELLITE PROGRAM (VACSAT)
Russell T. Jordan *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 238–251 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 06M

One of the primary objectives of Biosatellite II was to determine the effect of weightlessness on the ultrastructure and growth characteristics of microorganisms. The data from these experiments clearly show that bacterial cultures grown in a liquid medium produce significantly larger populations and have higher growth rates, as a result of space flight, than do identical control cultures on Earth. This paper will discuss some potential applications for manufacturing pharmaceuticals in an "Orbital Work Shop" and present a preliminary design for a "Zero G Fermenter" with a proposed method for the unprecedented utilization of weightlessness in industrial fermentation. Author

N70-14701# National Research Council of Canada, Ottawa (Ontario). Translations Section.
ESTIMATION OF AN INTERNAL CONTAMINATION WITH URANIUM FROM URINARY EXCRETION RATES [ABSCHAETZUNG EINER INTERNEN KONTAMINATION MIT URAN AUS DEN URINAUSSCHEIDUNGSRATEN]
W. M. Pusch 1969 27 p refs Transl. into ENGLISH from Atomkernenergie (Munich), v. 11, no. 9-10, 1966 p 404–413
(NRC-TT-1375) Avail: CFSTI

Previously studied works on the excretion of uranium by the human organism are compared and an attempt is then made to construct a mean excretion curve for the two most important cases. From still scant data that are available, the following are the principal conclusions drawn: In the case of single intakes (accidents) where the subject works with soluble uranium compounds, urine samples should be taken at least every 2 to 3 1/2 days, but this does not appear to be practical as a routine. For a more accurate estimate of the body burden from excretions of uranium in the urine, a knowledge of the time of the incident is absolutely necessary on account of the initially very strong change in the excretion rate. If an incident is discovered only as a result of a routine analysis of the urine, it is generally no longer possible to determine the time of that incident. As a consequence, the value of an investigation level for single intakes is greatly reduced, so that extremely careful supervision of working conditions appears all the more essential. Author

N70-14728# Atomic Energy Commission, New York.
USSR REPORTS ON NATURAL AND FALLOUT RADIOACTIVITY
1 Feb. 1969 176 p refs Transl. into ENGLISH from Akad. Nauk SSSR reports
(AEC-tr-7030) Avail: CFSTI

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8. AN EXPONENTIAL SOURCE AS A MODEL OF RADIOACTIVE CONTAMINANTS V. V. Pavlov et al p 106–118 refs (See N70-14734 04-24)

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10. SOME QUANTITATIVE FEATURES OF ENVIRONMENTAL CONTAMINATION BY Sr-90 DURING A PERIOD OF STRATOSPHERIC DEPOSITION Yu. S. Stepanov et al p 131–133 refs (See N70-14736 04-04)

11. METHODS OF STUDYING THE BEHAVIOR OF RADIOSTRONTIUM IN SOILS OF DIFFERENT GEOCHEMICAL REGIONS E. B. Tyuryukanova p 134–144 refs (See N70-14737 04-24)

12. CHARACTER OF THE VERTICAL DISTRIBUTION OF CS-137 IN SOIL IN CERTAIN AREAS OF THE SOVIET UNION, 1966-1967 G. A. Fedorov et al p 145–148 refs (See N70-14738 04-04)

13. CESIUM 137 CONCENTRATION IN HUMAN HAIR AS AN INDICATOR OF THE AMOUNT OF THIS ISOTOPE IN THE BODY P. V. Ramzaev et al p 149–151 refs (See N70-14739 04-04)

14. VERTICAL DISTRIBUTION AND EVALUATION OF THE MOBILITY OF FISSION PRODUCTS IN CERTAIN SOIL TYPES OF THE SOVIET UNION V. F. Brendakov et al p 152–156 ref (See N70-14740 04-04)

15. RADIOMETRIC APPARATUS FOR DETERMINING Sr-90 CONTENT OF SEA WATER S. M. Vakulovskii et al p 157–162 refs (See N70-14741 04-14)

16. POLONIUM 210 IN THE HUMAN BODY AND IN THE ENVIRONMENT A. P. Ermolaeva-Makovskaya et al p 163–170 refs (See N70-14742 04-04)

N70-14727# Atomic Energy Commission, New York.
PECULIARITIES OF THE MIGRATION OF TOTAL Cs-137 FROM SANDY PODZOLIC SOILS THROUGH THE FOOD CHAIN INTO THE HUMAN BODY
A. A. Moiseev et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 1–13 refs (See N70-14726 04-04)
(A-AC-82/G/L-1187) Avail: CFSTI

Soil, hay, cereals, milk, meat, and total diet for the inhabitants of two populated sites were sampled in November, 1966, and the Cs-137 body burden of people of various age groups were measured with a portable single channel gamma spectrometer. Tables are presented to show results. On transferring from turf-podzolic sandy soils along the food chain, Cs-137 reaches higher levels in vegetation, in agricultural products (meat and milk), and in the body of the inhabitants of that district. Increased Cs-137 content in individual links of the soil-vegetation-cow-man chain is caused only by specific conditions of the soil in the given area, that fixes the fallout Cs-137 only weakly. The average body burden of Cs-137 of adults living in these areas is 55 micron Ci. The internal Cs-137 gonad doses to the adult population of the area fluctuated from 3 to 17 mrad/yr. NSA

N70-14728# Atomic Energy Commission, New York.
DIFFUSION OF STRONTIUM-90 IN SOILS
Yu. A. Polyakov et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 14–25 refs (See N70-14726 04-04)
(A-AC-82/G/L-1242) Avail: CFSTI

The diffusion of Sr-90 was studied in several varieties of black earth and forested-steppe soils found within the arid steppe zone of Russia. Both field and laboratory observations were made. The physiochemical properties of these soils which were determined included the organic content, the pH of aqueous suspension, absorption capacity, and the composition of the absorbed bases. The laboratory methods used and the theoretical method for computing soil diffusion characteristics based on Fink's equation are explained. The Sr-90 studies showed that: the diffusion coefficients for the soils studied on the properties of the soil; the diffusion coefficient was constant only for homogeneously prepared soil samples, and, under natural soil conditions, the diffusion coefficient must be considered as variable; and, the methods developed for preparing soil samples and for solving Find's equation could be used for studying the diffusion of ions other than Sr-90. NSA

N70-14729# Atomic Energy Commission, New York.
Sr-90 IN BONE IN THE SOVIET UNION (1957–1967)
A. I. Marei et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 26–39 (See N70-14726 04-04)
(A-AC-82/G/L-1244) Avail: CFSTI

Levels of Sr-90 produced by nuclear weapons tests in various populations of the Soviet Union during 1957 to 1967 were evaluated. Pathological specimens were obtained from 99 cities in various geographical districts chosen for climatic and other factors that might influence the uptake of Sr-90. Bone and teeth specimens were dried and ashed and measurements were made with low background counters. Results are shown by means of tables and graphs. Changes in Sr-90 concentration were characterized by a considerable rise during 1963 to 1966; in adults a tendency towards lower values was noted in 1967. The highest mean annual bone dose from Sr-90 was observed in 1964 for children born in 1962. NSA

N70-14730# Atomic Energy Commission, New York.
DIETARY INTAKE OF STRONTIUM 90 AND CESIUM 137 BY THE POPULATION OF THE USSR IN 1966–1967 AS A RESULT OF STRATOSPHERIC FALLOUT
E. V. Petukhova et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 40–48 refs (See N70-14726 04-04)
(A-AC-82/G/L-1245) Avail: CFSTI

Quantities of radioisotopes consumed by the population were determined by radiochemical and spectrometric methods. The tabulated results show that there was a decline in the Cs-137 and Sr-90 levels in basic food products. The rate of decline was different for milk, bread, cereals, meat, fish, vegetables, fruits, and water. During the first half of 1967 some population groups received a third to a half less of these radioisotopes than during the same period of 1966. NSA

N70-14731# Atomic Energy Commission, New York.
MECHANISMS OF RADIOECOLOGICAL CONCENTRATION PROCESSES IN SEAS AND OCEANS
G. G. Polikarpov *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 49–64 refs (See N70-14726 04-04)
(A-AC-82/G/L-1247) Avail: CFSTI

The mechanisms of absorption and accumulation of radioisotopes by aquatic organisms from the carriers in the water medium are discussed. The importance of the food chain in migration of radioisotopes through the environment is pointed out. A discussion is presented of the significance of accumulation coefficients of radioisotopes in closely related species occurring in different seas and oceans for extrapolation of data on radioactivity of the organisms or of the medium. Tables are presented to show concentrations of Ce-144, Mn-54, Ru-106, and Sr-90 in Sargassum natans and coefficients of accumulation of Ce-144, Cs-137, Ru-106, and Sr-90 in larvae and adults of the crab, Planes minutus. Radioecological studies on fishes, mammals, seaweeds, and plankton from various regions of the Pacific, Atlantic, and Indian Oceans are reported. Radioecological surveys of the southern seas of the Soviet Union are described. Studies on coefficients of accumulation and isotopic mixing in the flora and fauna of the Black Sea are reported. Cytogenetic studies were conducted on fish of the Black Sea. NSA

N70-14732# Atomic Energy Commission, New York.
SR-90 AND CS-137 IN CERTAIN PARTS OF THE EXTERNAL ENVIRONMENT AND IN THE HUMAN BODY, 1958–1967
A. S. Zykova et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 65–74 (See N70-14726 04-04)
(A-AC-82/G/L-1248) Avail: CFSTI

Ten years of observations carried out in Moscow on the radioisotope content of air, certain foods, ground-level fallout and infants' bones are summarized. It was established that from 1958 to 1967, 52 mCi/sq km of Cs-137 and 33 mCi/sq km of Sr-90 were deposited on the surface of the earth in the Moscow area. The highest values for radioactive substances were observed during 1962 to 1963. When the 1967 measurements were compared with data from 1962 to 1963, it was found that the Cs-137 and Sr-90 content of milk decreased by factors of 13.3 to 14.3; of ground-level fallout by factors of 7.7 to 8.1; and of milk by factors of 7.6 and 3.0 respectively. Observations in 1965 to 1967 satisfactorily confirm the relation established earlier between the Cs-137 and Sr-90 contents of air and ground surfaces, ground surfaces and milk, and milk and children's bones. The Cs-137/Sr-90 ratio in air, surface fallout and milk is not the same. NSA

N70-14735# Atomic Energy Commission, New York.
THREE- AND FOUR-COMPONENT MODELS OF CESIUM METABOLISM IN RATS AND HUMAN BEINGS
G. P. Krasnoshchekova et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 119–130 refs (See N70-14726 04-04)
(A-AC-82/G/L-1251) Avail: CFSTI

A method of obtaining constants that characterize the processes of cesium exchange in warm blooded animals is

described. The entire metabolic system is represented as a set of compartments joined by a number of transfer links. Diagrams and equations are presented for describing three and four compartment models of Cs-137 exchange. Consideration of the compartments may be of interest in protecting the human organism against radiation: for example, slowing down the process of cesium transition from the ionic state to the organically bound state, or accelerating the removal of the latter from intracellular fluid into extracellular fluid. The models might also be used for medical diagnosis of liver and other pathologies. NSA

N70-14736# Atomic Energy Commission, New York.
SOME QUANTITATIVE FEATURES OF ENVIRONMENTAL CONTAMINATION BY SR-90 DURING A PERIOD OF STRATOSPHERIC DEPOSITION
Yu. S. Stepanov et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 131–133 refs N70-14726 04-04)
(A-AC-82/G/L-1252) Avail: CFSTI

A study was made of Sr-90 uptake from soil and air by potatoes, grain, milk, and other dietary factors of the adult urban population in the entire Soviet Union following nuclear weapons tests. Mathematical models are given to represent these concentrations in the environment. The relation between the content of Sr-90 in bones of children up to one yr of age and that in the mother's diet exerts an influence both during the child's prenatal development and during the first ten months of life. After weaning contamination of cow's milk determines changes in the Sr-90 concentration in bones of children. A table is presented to show confidence limits of correlation coefficients for milk, potatoes, wheat, and bones of children. NSA

N70-14738# Atomic Energy Commission, New York.
CHARACTER OF THE VERTICAL DISTRIBUTION OF CS-137 IN SOIL IN CERTAIN AREAS OF THE SOVIET UNION, 1966-1967
G. A. Fedorov et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 145–148 refs (See N70-14726 04-04)
(A-AC-82/G/L-1256) Avail: CFSTI

The vertical distribution of Cs-137 in soil at four sites in the USSR was measured in 1966 and 1967 and compared with similar data acquired before 1961. The sampling and measurement procedures are described. The results indicate that Cs-137 activity decreases more rapidly with depth than does Sr-90 activity and is practically all concentrated in an upper layer 2 cm deep. 42 to 82% of all the Cs-137 activity, including that in the plant cover, was at a depth less than 6 mm. The relaxation lengths for Cs-137 in soil exceeded those observed before the 1961 to 1962 tests, and can be explained by the fact that the powerful 1961 and 1962 tests resulted in fallout deposition during 1963 to 1965 and by assuming that the Cs-137 deposited in 1966, unlike that produced in tests up to 1959, had not had time to migrate appreciably into the soil. Further studies of this time dependence factor and of the effects of other soil types is recommended. NSA

N70-14739# Atomic Energy Commission, New York.
CESIUM 137 CONCENTRATION IN HUMAN HAIR AS AN INDICATOR OF THE AMOUNT OF THIS ISOTOPE IN THE BODY
P. V. Ramzaev et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 149–151 refs (See N70-14726 04-04)
(A-AC-82/G/L-1257) Avail: CFSTI

Hair collected in Leningrad barber shops was analyzed for Cs-137 and potassium, and measurements were made of the Cs-137 content of the hair and body of reindeer herders. The tabulated results show a close correlation between amounts in the hair and body. Results suggested that the concentration of the isotope along the length of the hairs was the same only if the amount of Cs-137 remained constant in the body during the entire period of hair growth. It was concluded that analysis of hair for Cs-137 can be used only for a radiation health evaluation of the mean dose created by Cs-137 in the body of the inhabitants of a particular region. NSA

N70-14740# Atomic Energy Commission, New York.
VERTICAL DISTRIBUTION AND EVALUATION OF THE MOBILITY OF FISSION PRODUCTS IN CERTAIN SOIL TYPES OF THE SOVIET UNION
V. F. Brendakov et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 152–156 ref (See N70-14726 04-04)
(A-AC-82/G/L-1258) Avail: CFSTI

Samples of two types of undisturbed Russian soil, in 3 mm thick layers, were collected and examined during 1963 to 1966 to determine the vertical distribution and mobility of the following fission products: Ce-144, Cs-137, Ru-106, Sb-125 and Sr-90. The results showed over 76% of all the radioisotopes were in the top 20 mm soil layer with only traces below a depth of 150 mm, and that the transfer of the bulk of the radioisotopes did not exceed a few mm per year. NSA

N70-14742# Atomic Energy Commission, New York.
POLONIUM 210 IN THE HUMAN BODY AND IN THE ENVIRONMENT
A. P. Ermolaeva- Makovskaya et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 163–170 refs (See N70-14726 04-04)
(A-AC-82/G/L-1260) Avail: CFSTI

Determinations were made of the Po-210 content of the air, water, and food products in Leningrad. Food products analyzed were fish, meat, eggs, milk, wheat, barley, rye, tea, coffee, potatoes and green vegetables. From data on the content of Po-210 in urine and feces it was estimated that the people of Leningrad ingest about 4 pCi per day. Determinations were made of the Po-210 and sulfur content of the tissues of smokers and non-smokers. Analyses of bones of smokers showed that the Po-210 content was two to three times greater than that of nonsmokers. Ratios of the Po-210 content of the kidneys, muscles, and spleen to that of the liver were determined. Results are tabulated. NSA

N70-14743# Texas Christian Univ., Fort Worth. Inst. for Study of Cognitive Systems.
PARAMETERS OF HUMAN PATTERN PERCEPTION Semiannual Progress Report, 18 Mar.–18 Sep. 1969
Selby H. Evans 18 Oct. 1969 29 p refs
(Contract DAAD05-68-C-0176)
(AD-695715; SAPR-4) Avail: CFSTI CSCL 5/10

A methodology for directly determining the extent to which Ss utilize statistical properties of features is reported. Empirical progress in identifying the principles underlying selection of feature spaces and relevant encoding and storage processes is discussed. Support for both feature selection on the basis of statistical properties and the storage notion of schema plus correction is provided by these studies. The report also includes a discussion of experiments directed toward determining appropriate response modes for maximizing behavioral data. On the basis of these studies it appears that similarity ratings provide more refined information about pattern processing while not substantially effecting task performance. A study is presented which shows a modest correlation between IQ scores and performace on a schematic concept formation task. Possibilities for using the schematic concept formation task as a personnel selection device are considered. Finally, progress on two lines of theoretical development is described. Author (TAB)

N70-14844*# Naval Aerospace Medical Inst., Pensacola, Fla.
PROGRESSIVE ADAPTATION TO CORIOLIS ACCELERATIONS ASSOCIATED WITH 1-RPM INCREMENTS

IN THE VELOCITY OF THE SLOW ROTATION ROOM
James T. Reason and Ashton Graybiel 17 Jul. 1969 20 p refs (NASA Order R-93)
(NASA-CR-107475; NAMI-1081; Rept-164) Avail: CFSTI CSCL 06S

Specific questions relating to the design of an adaptation schedule effective in protecting against motion sickness in a rotating environment are discussed. Ten men with normal vestibular function executed controlled head and body movements at each of ten 1-rpm step increases in the velocity of the Pensacola Slow Rotation Room. On the completion of each movement, subjects were required to indicate whether or not they had detected sensations of vestibular or somatosensory origin. At each velocity step, the movements were continued until each of twenty four consecutive movements had elicited a negative response and the subject was judged to be symptom free. When this arbitrary adaptation criterion was reached, the angular velocity was increased by one rpm and the procedure repeated. On attaining the criterion at the terminal velocity (10 rpm), the rotation was stopped and the postrotatory phenomena were investigated using the same techniques. Author

N70-14880# Air Force Systems Command, Wright-Patterson AFB, Ohio.
EFFECT OF SPACELIGHT ENVIRONMENT ON SEEDS OF CERTAIN HIGHER PLANTS ON BOARD COSMOS 110
N. L. De Lone et al 12 Mar. 1969 9 p refs
(AD-693819; FTD-HT-23-1098-68) Avail: CFSTI CSCL 21/5

The reactions of dry seeds to ionizing irradiation and weightlessness are being studied to provide information on the mechanism of biologic effects of spaceflight factors, especially ionizing irradiation. Reactions to an integral dose of 12 RAD average dose rate 500 MRAD/Day irradiation in the Earth's radiation belts during the 22-day flight of Cosmos 110 are compared with data obtained from previous Vostok flights. The test and control seeds were subjected to cytological examination. Germination growth energy and the number of chromosome rearrangements in primary roots were compared in a variety of seeds–pine, wheat, barley, and pea. Reliable differences in rearrangements were determined only in the pine seeds. Despite the greater radiation dosage and longer weightlessness encountered on board Cosmos 110, the results did not differ significantly from those obtained in the Vostok flights. Some small physiological shifts were exhibited by the seeds during germination, and certain disturbances in their hereditary structures were noted. The need is pointed out for caution in evaluating these results some of the differences noted may be due to experimental errors. Author (TAB)

N70-14886*# Naval Aerospace Medical Inst., Pensacola, Fla.
AN ATTEMPT TO MEASURE THE DEGREE OF ADAPTATION PRODUCED BY DIFFERING AMOUNTS OF CORIOLIS VESTIBULAR STIMULATION IN THE SLOW ROTATION ROOM
James T. Reason and Ashton Graybiel 16 Jul. 1969 14 p refs (NASA Order R-93)
(NASA-CR-107442; NAMI-1084) Avail: CFSTI CSCL 06S

A quantitative estimate was obtained of the degree of adaptation acquired as the result of different amounts of coriolis stimulation. Subjects executed a predetermined number of controlled 90 deg head motions at 5 rpm in the slow rotation room. Three measures of adaptation were used: (1) the number of perrotatory head movements evoking sensations due to the coriolis acceleration, (2) the direction and duration of the coriolis oculogyral illusion both during and immediately after the period of rotation, and (3) the number of postrotatory motions producing some detectable after-sensation. The first measure was included to provide an indication of individual differences in adaptability; the remaining two were designed to reveal treatment effects. Six conditions of exposure, ranging from 30 to 180 sequences of eight head motions each, produced no measurable differences in the degree of adaptation acquired. A positive and significant correlation was obtained between the number of perrotatory motions evoking a coriolis reaction (irrespective of the total number of sequences executed) and the number of postrotatory motions producing an after-sensation. Author

N70-14889*# National Research Council of Canada, Ottawa (Ontario).
THE EFFECT OF PSYCHOLOGICAL STRESS ON DECISION PROCESSES IN A TRACKING TASK
C. B. Gibbs *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 231–252 refs (See N70-14876 04-05)
Avail: CFSTI

The human brain is the most complicated control system on Earth , but little is known of the operational methods that are used within the central nervous system. However, recent research on biological control mechanisms has produced findings and inventions of potential social value in reducing accidents. Many forms of psychological stress impair a person's ability to control a machine and are undoubtedly major causes of accidents. Stress is defined as a force that can produce strain or distortion in a system. Psychological stress can be applied to human beings by the use of alcohol, drugs, or by fatigue, frustration, or many other influences. It is extremely difficult to detect impairment in actual performance because increased expenditure of energy or effort may mask the effects of stress on the aspects of behavior that are readily observed and measured. The precision of tracking movements made in a limited time is frequently measured in laboratory studies of stress. Precision is obviously important in controlling machines, but it is clear that incorrect decisions, rather than lack of precision in executing movements, are major causes of accidents. Author

N70-14910*# Illinois Univ., Chicago.
EFFECTS OF EXTERNAL LOADING ON HUMAN MOTOR REFLEXES
Gyan Agarwal, Bradley Berman, Michael Hogins, Peter Loehnberg, and Lawrence Stark *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 551–567 refs (See N70-14876 04-05)
Avail: CFSTI CSCL 06P

Achilles tendon reflex in normal human subjects is quantitatively studied from the viewpoint of multiinput, multioutput systems theory. Isometric and isotonic reflex have been elicited in the gastrocnemius-soleus muscle to study the relationship between the initial conditions (muscle tension or length), the stimulus (hammer force) and the reflex response (change in foot torque or angle). In the isometric case, foot–torque response is shown to be a function of initial foot torque. In the isotonic case with no external loading, the foot–angle response is strongly related to hammer force, and a plateau in the response is observed. In the isotonic case with external loading, the foot–angle response is strongly related to involuntary initial foot angle as well as the hammer force. Author

N70-14911*# Illinois Univ., Chicago.
MODELS OF MUSCLE PROPRIOCEPTIVE RECEPTORS
Gyan Agarwal, Gerald Gottlieb, and Lawrence Stark *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 569–594 refs (See N70-14876 04-05)
Avail: CFSTI CSCL 06P

Three lumped parameter models of muscle stretch receptors are described quantitatively on the basis of data obtained from crustacean, amphibian, and mammalian muscle spindles. The first two of these models have single efferent (input) and single afferent (output) innervation. The third model is based on more recent anatomical and physiological studies on mammalian muscle spindles showing two functionally distinct types of efferent innervation and two types of afferent innervation. Author

N70-14979*# George Washington Univ., Washington, D.C. Medical Center.
SCIENTIFIC PUBLICATIONS AND PRESENTATIONS RELATING TO PLANETARY QUARANTINE, VOLUME 5
Frank D. Bradley and Sandra G. Moritsugu Nov. 1969 73 p refs
(Contract NSR-09-010-027)
(NASA-CR-107455) Avail: CFSTI CSCL 06M

In the continuation of a sustained effort to compile a list of publications of NASA - Planetary Quarantine studies, this bibliography presents available reports issued in the calendar year 1968. The parameters of selection of material used in the 1966 and 1967 editions of this series, have been broadened to include some non-NASA funded but Planetary Quarantine oriented material. Also included are a few documents of earlier years; back-gathering of documents not previously listed will be continued in subsequent editions of this publication. Author

N70-15056# Retina Foundation, Boston, Mass. Dept. of Research.
ENHANCEMENT OF NIGHT VISION BY CORRECTION OF OPTICAL ABERRATIONS OF THE EYE Annual Summary Report, 1 Oct. 1968 - 30 Sep. 1969
Oleg Pomerantzeff, Harold Fish, Jacques Govignon, and Charles L. Schepens 1 Jul. 1969 24 p refs
(Contract DADA17-69-C-9030)
(AD-695718) Avail: CFSTI CSCL 6/16

An automatic program has been designed for computation of the optical model of any given eye. The program accepts as data a set of parameters which are measurable in the living eye. An apparatus has been designed and built for easy subjective and/or objective measurement of aberrations in the living eye. Author (TAB)

N70-15081# National Research Council of Canada, Ottowa (Ontario). Translations Section.
PHOTOCHEMICAL INVESTIGATION OF THE CYTOSTATICALLY ACTIVE URACIL DERIVATIVES [PHOTOCHEMISCHE UNTERSUCHUNGEN AN CYTOSTATISCH WIRKSMAN URACILDERIVATEN]
Kailash K. Gauri 1969 6 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), v. 22b, no. 6, 1967 p 685-686
(NRC-TT-1390) Avail: CFSTI

Dimerization reaction of uracil dervatives irradiated by ultraviolet light was investigated in vitro. Percentage absorption changes in uracil and its derivatives after ultraviolet irradiation were tabulated along with percentage dimerization of uracil derivatives compared with uracil and thymine. It is concluded that with an incorporation in nucleic acids, radiation sensitization will not take place to the same extent as with thymine. Photochemical dimerization methods are briefely discussed. J.A.M.

N70-15121# Air Force Systems Commmand, Brooks AFB, Tex. School of Aerospace Medicine.
EFFECTS OF DECABORANE ON LIVER GLYCOGEN CONTENT OF RATS AT GROUND LEVEL AND AT ALTITUDE Final Report, Sep. 1965-Jan. 1966
Ralph E. Grandberry and Miguel A. Medina Aug. 1969 12 p refs
(AD-695789; SAM-TR-69-48) Avail: CFSTI CSCL 6/20

The effect of decaborane (15 mg./kg.) on the hepatic glycogen of male rats maintained at altitude (18,000 ft.) under normoxic conditions was compared with the effect on similarly injected, ground level controls. Results showed that decaborane decreased the glycogen level of fed rats at ground level, but did not affect glycogen levels in the fed, altitude group. The hepatic glycogen level of fasted rats at altitude was the equivalent of that of fasted rats at ground level. These results indicate that the mechanism whereby decaborane produces a depletion of liver glycogen is altered under conditions of reduced pressure. Author (TAB)

N70-15208*# Naval Aerospace Medical Inst., Pensacola, Fla.
NUCLEAR EMULSION RECORDINGS OF HEAVY PRIMARIES ON APOLLO 7 AND 8
Hermann J. Schaefer and Jeremiah J. Sullivan Oct. 1969 15 p refs Sponsored by NASA
(NASA-CR-107565; NAMI-1091) Avail: CFSTI CSCL 06R

Data from Apollo 7 and 8, the former a 10.8-day orbital mission and the latter a 6.1-day lunar mission, are used for identifying the indicated difference of fluxes and energy spectra of galactic heavy primaries encountered on a lunar mission from those on a near-Earth orbital mission by measurements in the nuclear emulsions carried by the astronauts in their garments. A total of 84 track segments of Z > or = 20 was counted in 5.99 cm2 emulsion area for Apollo 7 and of 76 segments in 1.82 cm2 for Apollo 8. This represents a flux of 1.3 nuclei/(cm2 24 hours) for Apollo 7 and of 6.86/(cm2 24 hours) for Apollo 8. By applying QF factors as recommended by the ICRP to the absorbed doses of 0.42 millirad for Apollo 7 and 1.5 millirads for Apollo 8, the corresponding dose equivalents of 6.5 and 23.9 millirems, respectively, were obtained. These contributions constitute 4 per cent of the total mission dose equivalent for Apollo 7 and 12 per cent for Apollo 8. The results indicate that heavy nuclei contribute sizeably to the astronaut's radiation exposure on deep-space missions outside the magnetosphere. Author

N70-15343# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
DETERMINATION OF TRACE QUANTITIES OF URANIUM IN BIOLOGICAL MATERIALS BY THE NUCLEAR TRACK TECHNIQUE
B. Stephen Carpenter *In its* Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 942-945 refs (See N70-15313 04-06)
Avail: SOD $8.50

Plans are to certify three biological Standard Reference Materials for trace elements: blood, tissue, and a botanical leaf sample. Of these materials, blood, plasma, and dried leaves, were used. Each sample was freeze-dried to remove most of the water, then ashed at a low temperature in an oxygen atmosphere using a low temperature dry asher. The residue was digested in nitric acid, filered, and diluted to a known volume. Controlled drops of sample solution, delivered from a micropipette, were placed on Lexan slides. The solutions were evaporated to dryness on a laminar flow clean bench. Standard samples containing known amounts of uranium were mounted on Lexan detectors in an identical manner to establish for specific irradiation conditions the relationship between the number of tracks observed and the weight of uranium present. The analyses of uranium in blood gave an average value of 56.1 parts per billion (ppb), with a standard deviation of 5.6 ppb. The average value of the uranium content of mammalian plasma was found to be 60.5 plus or minus 12.0 ppb. Author

N70-15371# New York Univ., N.Y. Inst. of Environmental Medicine.
REGRESSION ANALYSIS OF GAMMA-RAY SPECTROMETER DATA WITH AN APPLICATION TO THE ASSAY OF HUMAN RADIOACTIVITY BURDENS
Bernard Pasternack and Naomi Harley *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1220-1230 refs (See N70-15313 04-06)
(Contract AT(30-1)-3136)
Avail: SOD $8.50

A method which permits correction for gain and baseline discrepancies between the reference and mixture pulse-height distributions is described. The procedure involves an iterative transformation of reference pulse-height distributions until a best least-squares regression is obtained; the basic statistical model assumes that a background corrected pulse-height distribution for a mixture of nuclides is equal to some linear combination of individual characteristic distributions for the constituent nuclides. Included are

typical pulse-height distributions taken from plots made by an IBM 1401 printer for specific nuclides and an arbitrary mixture of these nuclides, plots of normalized residuals resulting from analyses under various model conditions, and plots of two reference spectra of cesium 137. In addition, results of a biological sampling experiment are given to indicate recent application to total-body counting measurements. A.C.R.

N70-15387*# California Univ., San Diego. Visibility Lab.
FACTORS UNDERLYING VISUAL SEARCH PERFORMANCE
John H. Taylor Nov. 1969 27 p refs Presented at NATO Symp. on Image Evaluation Munich, Aug. 1969
(Grant NGR-05-009-020)
(NASA-CR-107574; SIO-69-22) Avail: CFSTI CSCL 06P

Visual search in man as a special case of image evaluation is studied from simple detection of an object to the complex detection and identification of hidden camouflaged military targets. The factors in evaluating images are listed as: properties of the human visual system, properties of objects and their backgrounds, and properties of the environment. The retina, muscular mechanism, visual fields, eye movement, and visual functions are discussed, and graphs are presented for contrast discrimination, fixation, and search time. F.O.S.

N70-15400*+ Battelle-Northwest, Richland, Wash.
INDUCED RADIONUCLIDES IN ASTRONAUTS Final Report, 15 Jun. 1967 – 1 Sep. 1968
R. L. Brodzinski, N. A. Wogman, and R. W. Perkins 1 Sep. 1968 56 p refs Sponsored in part by NASA
(NASA-CR-107583; BNWL-531-4) Avail: CFSTI CSCL 06R

Activity-dose energy relationships for Be7, N13, Na22, and Na24 activities induced in unshielded muscle tissue and tissue equivalent phantoms by bombardment of protons up to 580 MeV were measured, and the relationship between radiation dose and induced activity for any given proton bombarding energy is defined. The determination of the radiation dose received by an astronaut from cosmic radiation of unknown energy by measuring the concentration of the radioactive isotopes induced in his body is discussed. Measurements to define the excretion pattern of induced radionuclides from proton irradiated patients, and studies of the cosmic-ray dose to high altitude pilots were also continued. Author (NSA)

N70-15407*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE 24-HOUR RHYTHM OF CHLORINE SECRETION [DER 24-STUNDEN-RHYTHMUS DER CHLORAUSSCHEIDUNG]
F. Gerritzen Washington NASA Dec. 1969 8 p refs Transl. into ENGLISH from Arch. Ges. Physiol. (Berlin), v. 238, 1937 p 483 – 488
(Contract NASw-1692)
(NASA-TT-F-12705) Avail: CFSTI CSCL 06P

The results of an experiment on chlorine secretion which lasted 27 hours and in which 35 persons considered to be healthy took part are described. The subjects ate and drank the same each hour. They voided urine hourly. The amount of urine was measured and in each portion the chlorine content was determined according to Volhard's method. The mean value for each hour was calculated and plotted in a curve. The parallel between chlorine secretion and diuresis is clear. The rhythm in chlorine secretion is considered a liver rhythm. The peak in diuresis, which occurs at 12 p.m. and which is not followed by a rise in chlorine secretion, is connected with the change in body posture. The circumstance that excessive fluid is eliminated as urine is considered the first sign of heart insufficiency in young healthy persons; i.e., as pathological. On the basis of the fact that the maximum chlorine secretion precedes the maximum diuresis by two hours, the existence of the liver barrier assumed by Mautner and Pick is called into question. Author

N70-15415# Electro-Optical Systems, Inc., Pasadena, Calif.
DISPLAY REQUIREMENTS ASSESSMENT FOR COMMAND AND CONTROL SYSTEMS
Rudolph L. Kuehn *In* AGARD Displays for Command and Control Centers Jul. 1969 p 81 – 92 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI

The major underlying parameters of a command and control display depend to a great extent upon the basic attributes of the human visual mechanism. The latter are briefly reviewed in order to place the display system requirements in harmony with visual limitations. Resolution, amount of data displayed, display dynamics, coding and screen size are discussed. Illustrations are given by means of figures and tables of the interrelationship of certain of these criteria. Material is presented demonstrating that display specification and design need not be based upon intuitive judgment, but do have a foundation in sound scientific and engineering principles. The proper parametric designation of the command and control display system can lead to greater effectiveness and overall satisfactory performance. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-14268*+ National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO 11 WATER SERVICING
A. P. Buck 10 Nov. 1969 87 p
(NASA-TM-X-64027; GP-779) Avail: CFSTI CSCL 06K

Operational problems involved in launch countdown and altitude chamber test are discussed. Work done included verification of spacecraft water support systems by chemical, microbiological, and particulate analysis. Test data sheets are appended. J.M.C.

N70-14464# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DECISION FUNCTIONS AND THE STATISTICAL NEURON MODEL
Vl. I. Belyakov-Bodin 10 Mar. 1969 17 p refs Transl. into ENGLISH from Akad. Nauk SSR, Vychislitelnyy Tsentr. Hroboty po Tekhn. Kibernetike (Moscow), 1967 p 24 – 36
(AD-695931; FTD-HT-23-1095-68) Avail: CFSTI CSCL 6/4

The author deals with theorems by means of which separating functions pertaining to the statistical teaching of artificial neuron models can be constructed in a simple manner in view of the possibility of constructing decision functions in which a statistical formulation of the pattern recognition problem is presented. TAB

N70-14587# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
DECISION MAKING NETWORKS IN PATTERN RECOGNITION
Leonard J. Grantner Apr. 1969 26 p refs
(Contract Nonr-266(66))
(AD-695413; ArtemiS-68) Avail: CFSTI CSCL 6/4

A feed forward switching network is described and then used as a basis for a pattern classifier. Rules associated with the network direct an arbitrary signal from a starting node to one of a group of terminal nodes, each of which is identified with a pattern class. The empirical distribution functions of a training set of pattern samples determine the manner in which the rules are constructed. The rules are functions of the input pattern binary variables. It is shown that, for a class of networks having the

ordering property and statistically ordered rules at each node, increasing the size of the network decreases the probability of error.
Author (TAB)

N70-14628# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PATTERN RECOGNITION IN THE ABSENCE OF A LEARNING PROCESS
I. Sh. Torgovitskiy 2 Jan. 1969 14 p refs Transl. into ENGLISH from Russian Publ. "Akad. Nauk SSR. Neuchn. Sovet po Kompleksn. Probl. "Kibernetika". Vopr. Bioniki" Moscow, Nauka, 1967 p 107–113
(AD-693825; FTD-HT-23-1223-68) Avail: CFSTI CSCL 6/4

Methods of pattern recognition in the absence of learning are examined. Information on the input situations enters the recognizer in the form of an n-dimensional vector so that any situation corresponds to a point in an n-dimension space. A situation is related to one of the classes according to the sign of the decision function. Given the equation of a hyperplane it is shown that, when certain factors are unknown, it is possible to determine the unknown coefficients that ensure the best division of the criterion space into two classes. Other methods are discussed.
Author (TAB)

N70-14629# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON ALGORITHMIZATION OF THE IMAGE RECOGNITION PROCESS
Yu. V. Vagin 14 Jul. 1969 9 p refs Transl. into ENGLISH of Russian publ. "Avtomaticheskoe Chtenie Teksta" Moscow, 1967 p 81–85
(AD-695947; FTD-MT-24-142-69) Avail: CFSTI CSCL 5/8

The development of an algorithm for the recognition process is discussed. It is assumed that in order to achieve recognition, the priori information must contain descriptions or images of classes which can be used to identify the unknown information. In the general case each class is determined with the aid of a set of parameters as a phenomena corresponding to certain probability conditions. The proposed method of constructing an algorithm is illustrated.
TAB

N70-14876*# National Aeronautics and Space Administration, Washington, D.C.
FOURTH ANNUAL NASA-UNIVERSITY CONFERENCE ON MANUAL CONTROL
1969 573 p refs Conf. held at Ann Arbor, Mich., 21–23 Mar. 1968
(NASA-SP-192) Avail: CFSTI CSCL 05H

Papers are presented on the following areas of investigation: quasi-linear describing function theory and applications; human performance theory; adaptive or higher order control processes; system identification, signal analysis, and performance measurement; effects of environmental variables on performance; control and display system design; models based on discrete signal processing; and neuromuscular a system analysis. For individual titles see N70-14877 to N70-14911.

N70-14877*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A MODEL FOR HUMAN CONTROLLER REMNANT
William H. Levison and David L. Kleinman *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 3–14 refs (See N70-14876 04-05)
(Contract NAS8-21136; NAS2-3080)
Avail: CFSTI CSCL 05H

A model of human controller remnant is developed and tested against measurements obtained from a variety of manual control experiments. Remnant is defined herein as that portion of the controller's output that is not linearly correlated with the input disturbance to the system. A number of potential sources of remnant are considered and the ability to distinguish between them is discussed. The proposed remnant model is expected to become an integral part of an analysis procedure for predicting the human's visual scanning and control behavior in complex, multivariable control situations.
Author

N70-14878*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THE HUMAN AS AN OPTIMAL CONTROLLER AND INFORMATION PROCESSOR
Sheldon Baron and David L. Kleinman *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 15–34 refs (See N70-14876 04-05)
(Contract NAS12-104)
Avail: CFSTI CSCL 05H

A mathematical model of the instrument monitoring behavior of the human operator is developed. The model is based on the assumption that the operator behaves as an optimal controller and information processor, subject to his inherent physical limitations. The resulting model depends explicitly on the control task and the control actions. Provision is made for the ability to obtain information from the peripheral visual field. There are no restrictions on signal coupling. The specific characteristics of the operator's visual sampling behavior are predicted by solving a nonlinear, deterministic optimization problem. A two-axis compensatory tracking example is investigated and the results exhibit the general characteristics expected of a human operator performing a similar task.
Author

N70-14879*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
MEAN SQUARE ESTIMATION OF HUMAN PILOT TRANSFER FUNCTIONS
Richard F. Whitbeck and Frederick D. Newell *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 35–45 refs (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

Mean square minimization (Wiener–Hopf) methods can be used as a complement to the remnant approach in the estimation of human pilot transfer functions. Moreover, the Wiener–Hopf approach is useful in that it offers a mathematically convenient tool for extending the definition of pilot transfer function to multiaxis input–output tasks.
Author

N70-14880*# Systems Technology, Inc., Princeton, N.J.
MULTIMODALITY PILOT MODEL FOR VISUAL AND MOTION CUES
R. L. Stapleford *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 47–57 refs (See N70-14876 04-05)
(Contract NAS2-3650)
Avail: CFSTI CSCL 05H

A preliminary model for pilot control behavior when utilizing both visual and motion cues is presented. The model is based on a detailed review of all known data, including some unpublished data from recent experiments. Models for the three feedback paths (visual, angular motion, and linear motion) and integration of the various feedbacks are described.
Author

N70-14881*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
SYNTHESIS OF HUMAN RESPONSE IN CLOSED-LOOP TRACKING TASKS
James J. Adams *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 59–66 refs (See N70-)
Avail: CFSTI CSCL 05H

Experiments were conducted to determine the variability in a human subject's control stick response to displayed displacement and rate of change of displacement to aid in the implementation of the time variations to be included in the model. Also,

additional tracking tasks were made to obtain a definition of the characteristics of the random noise to be added to the model. These two factors were then added to the model, and this composite model was placed in a control loop in place of the pilot. The results demonstrate that this composite model reproduces time-history characteristics and mean square system errors that more closely match the human subject than does the linear model. Author

N70-14882*# Systems Technology, Inc., Princeton, N.J.
APPLICATION OF A SYSTEMS ANALYSIS THEORY FOR MANUAL CONTROL DISPLAYS TO AIRCRAFT INSTRUMENT LANDING
W. F. Clement, H. R. Jex, and D. Graham *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 69–94 refs (See N70-14876 04-05)
(Contract N00014-66-C0072)
Avail: CFSTI CSCL 05H

An illustrative application is presented of a theory for manual control displays to the instrument landing approach of a large subsonic jet transport. A methodical procedure is disclosed for formulation of compensatory display/control systems. Manual approach height and lateral position control are treated in multiloop dynamic analyses so as to select preferred variables for measurement and display. Closed-loop system performance and pilot scanning and workload measures are also evaluated. The example concludes with the prediction of a preferred display arrangement. Comparison with an FAA category II instrument panel arrangement selected by an airline operating the example aircraft shows the predictions to be remarkably accurate. Author

N70-14883*# United Aircraft Corp., East Hartford, Conn. Research Labs.
AN ANALYSIS OF PILOT ADAPTATION IN A SIMULATED MULTILOOP VTOL HOVERING TASK
E. W. Vinje and D. P. Miller *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 95–117 refs (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

The pilot model adaptable parameters were computed from rms hovering performance data measured in flight simulator experiments for a variety of VTOL aircraft configurations. Variations in the aircraft stability parameters affected both the dynamic and disturbance-response characteristics of the controlled element. The pilot's pitch-loop adaptation generally correlated with the frequency domain characteristics of the pitch response to turbulence and the pitch response to control inputs. Gain was adapted to provide a crossover frequency that was high enough to control the disturbances due to turbulence and provide satisfactory hovering performance. Lead compensation was adapted in the region of crossover frequency to provide closed-loop stability. The influence of the aircraft position-loop characteristics on pilot pitch-loop adaptation was important only for configurations that had small attitude disturbances. Results also show that the pilot preferred to adjust pitch-loop gain by changing control stick sensitivity rather than by changing his internal adapted gain. Author

N70-14884*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MEASUREMENT OF PILOT DESCRIBING FUNCTIONS FROM FLIGHT TEST DATA WITH AN EXAMPLE FROM GEMINI 10
Rodney C. Wingrove and Frederick G. Edwards *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 119–134 refs (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

It is well known that there is an error in identifying the pilot describing function from routine flight test records because the pilot's output noise is correlated with the input error signal. It is shown that this identification error can be reduced in the computer processing by shifting the input signal an amount equivalent to the pilot's time delay. This technique for reducing the identification error is analyzed with theory and is demonstrated with the identification of a simulated pilot model. This technique is also applied to flight test records obtained from the retrofire phase of the Gemini 10 mission. Author

N70-14885*# Systems Technology, Inc., Princeton, N.J.
MODELS FOR STEERING CONTROL OF MOTOR VEHICLES
David H. Weir and Duane T. Mc Ruer *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 135–169 refs (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

Driver control of an automobile is analyzed using feedback models for the system that consists of the driver, the vehicle, and the roadway environment. Three alternative models are evolved that satisfy the guidance and control requirements of the driver/vehicle system. They are: time-advanced lateral position, path angle plus lateral position, and heading angle plus lateral position. Although there may be other alternatives, these provide good performance, insensitivity to variations in the driver's dynamic adaptation, good predicted subjective opinion rating, etc.; and they are compatible with perceptual data from driving experiments. The resultant models give the highway and vehicle designer a tool that can be useful in analyzing the system and in optimizing its parameters for the safest and most efficient operation. Author

N70-14886*# California Univ., Berkeley.
MAN-MACHINE MODELS FOR CAR STEERING
E. R. F. W. Crossman and H. Szostak *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 171–195 refs Sponsored by PHS (See N70-14876 04-05)
(Grants AC-00260; UI-00016) Avail: CFSTI CSCL 05H

The driver steering task and its environment are briefly described and the known properties of driver, highway, and vehicle reviewed. A three-level, information-processing model for driver steering control is developed. Level 1 uses preview estimates of highway curvature as a basis for open-loop adjustment of vehicle path curvature. Level 2 uses relative heading, relative path-angle, or lateral position-rate to null out residual lateral position-rate errors. Level 3 uses lateral position itself in a low-frequency, low-gain loop to remove residual error. Evidence for each of these is briefly reviewed. An auxiliary routine for controlling vehicle velocity to meet constraints on lateral acceleration is proposed as an adjunct to the model. Author

N70-14887*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HUMAN INFORMATION PROCESSING RATES DURING CERTAIN MULTIAXIS TRACKING TASKS WITH A CONCURRENT AUDITORY TASK
T. E. Wempe and D. L. Baty *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 199–220 refs (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

A series of experiments were conducted to determine the information processing rates of several subjects performing one- and two-axis compensatory tracking tasks with a secondary auditory task. The experimental variables were the order of controlled element dynamics, the forcing function, and the addition of a secondary task. Human information processing rates decreased on each tracking channel with the addition of the second tracking channel or the secondary auditory task. Other than this effect, the information processing channels were additive like parallel channels until a limit in the total information processing rate was reached. This limit was related to the order of the controlled element. Author

N70-14888*# Massachusetts Inst. of Tech., Cambridge.
PREDICTION AND DECISIONMAKING IN MANUAL CONTROL
William R. Ferrell and Harry S. Cohen *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 221–229 Sponsored in part by General Motors Corp., Detroit (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

A simple model of human decision making can be applied to a common class of decision situations, a model sufficiently unrestrictive to have a good chance of representing actual behavior. Among the cases to which the model applies are those classed as signal detection, and a considerable body of experimental evidence substantiates the model's usefulness and its applicability to this and other psychophysical detection tasks. It appears possible to extend the model to include many examples of decision making of practical importance in manual control, those in which an operator seeks to detect not a signal but his own potential success in carrying out an action. Author

N70-14890*# Michigan Univ., Ann Arbor.
PREDICTIVE COMPENSATION IN TIME-DELAY MANUAL CONTROL SYSTEMS
Eric A. King-Smith *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 253–274 refs (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

Almost since the birth of automatic control systems, the control of plants that include a pure time delay, or transport delay, has been a prime problem. There are several approaches through which adequate control of these plants may be implemented and the best controller selected in purely technological applications. Among these are the classic three-term controller, carefully selected data-sampling rates in conjunction with other linear or nonlinear compensation. Here we are going to consider the controller to be a human operator, in particular one employed in a visual-manual control task; this controller has fairly well-definable, adaptive characteristics if linearized, with bounds on the limits of adaptation of the various parameters determining the characteristics. With these limitations, supplementary compensation is generally necessary to enable the human operator to deal effectively with plants involving a time delay. A prime application example, of course, is the control of a vehicle on the Moon by an operator on Earth which involves a round-trip signal delay of 2.6 seconds. One particular group of compensation methods for time-delay systems makes use of another time delay as part of the equalizer for the improvement of system stability and performance. Particular interest will be focused here on the predictive control compensation. Author

N70-14891*# Pennsylvania Univ., Philadelphia. Systems Technology, Inc., Princeton, N.J.
PSYCHOLOGICAL AND PHYSIOLOGICAL SKILL DEVELOPMENT: A CONTROL ENGINEERING MODEL
Ezra S. Krendel and Duane T. Mc Ruer *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 275–288 refs Prepared in cooperation with Systems Tech., Inc., Princeton, N.J. (See N70-14876 04-05)
(Contract NAS2-2824)
Avail: CFSTI CSCL 05H

The application of servomechanism models to the description of human control behavior in either manual or physiological control has generally proceeded by creating circumstances under which behavior would be time stationary in an engineering sense over the duration of the measurements. Remarkably effective stationary steady-state models were achieved and applied with considerable success to the design of complex man-machine control systems. The problem is that conventional performance measures for human manual control or physiological control, interpreted in an invariant closed-loop configuration, are either relatively insensitive to human learning behavior or are inappropriate and misleading. A restructuring of the control configurations to enable the extracting of coherence and regularities from the input structures, either physically or conceptually, is the core of the model presented. Experimental data from many sources are presented to substantiate the model, and implications for system design and training are explored. Author

N70-14892*# University of Southern Calif., Los Angeles.
THE APPLICATION OF DISCRETE MODELING ELEMENTS TO THE SYNTHESIS AND IDENTIFICATION OF A DETERMINISTIC MODEL FOR THE VISUAL SCANNING BEHAVIOR OF HUMAN OPERATORS
M. J. Merritt *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 289–311 refs (See N70-14876 04-05)
(Grant NGR 05-018-022)
Avail: CFSTI CSCL 05H

A deterministic model for the visual scanning behavior of a human operator has been synthesized and partially identified. The applicability and generality of the proportional decision element and the multistate decision element to the modeling of discrete human operator behavior has been demonstrated. The hypothesis is advanced that the operator concentrated on one display, sampling the other only as often as needed. Whether this would have occurred if the operator generated continuous stick motions is impossible to say. Author

N70-14893*# Massachusetts Inst. of Tech., Cambridge.
STOCHASTIC MODELING OF HUMAN LEARNING BEHAVIOR
Jacob L. Meiry *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 315–321 refs (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

The application of a stochastic model of human learning behavior in manual control tasks is extended to the performance of the human operator in regulating all second order dynamic processes. In particular, human control decisions for optimal multiswitch and unstable dynamic systems are found to correlate well with responses recorded by the model in the study of simulated subjects. The universality of the model is discussed in the light of a series of compensatory task experiments. Author

N70-14894*# National Aeronautics and Space Administration, Washington, D.C.
CONTRIBUTIONS OF HUMAN BEHAVIOR AS A MULTILOOP CONTROLLER
G. Schweizer *In its* Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 323–340 (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

Experiments were conducted to review the existing describing function models on human behavior for single channel tasks. Random appearing stationary forcing functions and disturbances were present and it was assumed that the operator established stationarity during all the tests. The results of the analyzed data indicated that a linear model with random time varying coefficients provided a good description of the operator's behavior. Studies were conducted to determine what modifications to the single variable model system are necessary for a good representation of multivariable manual control systems. The experiments show that a sample data system with random sample intervals seems to be necessary. The application of the concept of information theory has been tried to assess the performance of the human operator in multiloop tasks. With the knowledge of the internal dynamics of the operator, there is some hope of determining performance indexes for manual control systems with the information theory method. Author

N70-14895*# Systems Technology, Inc., Princeton, N.J.
PILOT'S RESPONSE TO STABILITY AUGMENTATION SYSTEM FAILURES AND IMPLICATIONS FOR DESIGN
David H. Weir and Walter A. Johnson *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 341–360 refs (See N70-14876 04-05)
(Contract NAS2-3607)
Avail: CFSTI CSCL 05H

The dynamic response of the human pilot is studied during sudden changes in the effective controlled dynamics caused by stability augmentation system failure. Experimental results from multiple loop fixed base studies are presented. A hypothesis of graceful degradation is shown to be valid which states that the pilot's transition response and performance are improved if the difference in controlled element dynamics at failure is reduced. The design implications of this principle are detailed. A model for the pilot's dynamic response is presented which accounts for his behavior during the several phases of transition. Author

N70-14896*# University of Southern Calif., Los Angeles.
MODEL OF THE ADAPTIVE BEHAVIOR OF THE HUMAN OPERATOR IN RESPONSE TO A SUDDEN CHANGE IN THE CONTROL SITUATION
A. V. Phatak and G. A. Bekey *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 361–381 refs (See N70-14786 04-05)
(Grant NGR-05-018-022)
Avail: CFSTI CSCL 05H

An adaptive model is presented to describe the behavior of the human operator in response to sudden changes in plant dynamics and transient disturbances. The plant simulated for tracking experiments is approximately second order and has rate and attitude feedback augmentation for increased stability. The failure of the rate sensor and/or the attitude sensor results in a sudden transition in the order and gain of the effective plant dynamics. These failures may be accompanied by hard over transient conditions in either the rate or attitude sensors. The adaptive model suggested has a variable structure, contains mode switching based on pattern recognition as evidence, and incorporates the decision control logic required for successful adaptation to failures. The model in effect attempts to mimic the control strategy or algorithm used by a trained operator. Author

N70-14897*# Systems Technology, Inc., Princeton, N.J.
ON THE DYNAMIC RESPONSE OF THE HUMAN OPERATOR TO TRANSIENT INPUTS
Anil V. Phatak and David H. Weir *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 383–392 refs (See N70-14876 04-05)
(Contract AF-33(615)-3652)
Avail: CFSTI CSCL 05H

A dual mode controller is used to describe the operator's dynamic response to inputs containing both deterministic (transient) and random appearing signals. It includes the usual quasi-linear describing function plus a feedforward path which produces the transient response. New data are presented for step responses with effective controlled elements of K, K/s, K/s squared, and K/s cubed. They indicate that previously hypothesized sample-data models are primarily valid for pure gain controlled elements. The data show that step responses for a trained operator have portions which are nearly time optimal, and that this is one possible idealization for the feedforward, transient-response path in the model. Author

N70-14898*# Massachusetts Inst. of Tech., Cambridge.
STATE-SPACE MODELS OF REMOTE MANIPULATION TASKS
Daniel E. Whitney and Thomas B. Sheridan *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 393–404 refs (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

The state-space method has been shown to be capable of describing a wide variety of the logical and physical constraints which comprise manipulation. Using it, we can plan some nontrivial tasks and gain insight into the nature of tasks and commands. Combined with a flexible input language and carefully composed execution routines, it can provide a basis for supervisory controlled manipulation. Author

N70-14899*# University of Southern Calif., Los Angeles.
IDENTIFICATION OF SAMPLING INTERVALS IN SAMPLED DATA MODELS OF HUMAN OPERATOR
G. A. Bekey and C. B. Neal *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 407–412 refs (See N70-14876 04-05)
(Grant NGR-05-018-022)
Avail: CFSTI CSCL 05H

This paper develops two methods for the determination of an unknown sampling interval in closed-loop sampled-data systems. Both methods are based on a priori knowledge of the structure of the system to be identified and require that measurements be performed only on the system input and its (continuous) output. Author

N70-14900*# Systems Technology, Inc., Princeton, N.J.
CARDINAL RECONSTRUCTION THEORY: A TOOL FOR ESTIMATING EFFECTS OF DISPLAY SCANNING
Warren F. Clement *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 413–429 refs (See N70-14876 04-05)
(Contract N00014-66-C0072)
Avail: CFSTI CSCL 05H

A review of sampling processes and forms of continuous signal reconstruction therefrom has revealed several forms which may be useful in modeling the average display scanning behavior of the human operator. The most promising form appears to be cardinal reconstruction. Low frequency approximations to the effective time delay for linear reconstruction are only slightly greater than for truncated cardinal reconstruction. The influence of sampled first derivative and of sample dwell time appear analogous to the influence of sample prediction in reducing the effective reconstruction time delay. Since these reconstruction processes have similar low frequency responses, experimental attempts to isolate an effective reconstruction time delay in multidisplay control tasks may be confounded by the reconstruction process of the skilled operator or pilot. Indeed, the skilled pilot may exhibit little or no incremental reconstruction time delay beyond the basic reaction time delay in a single task to which continuous attention is given. Author

N70-14901*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
MOTION CUES IN MAN-VEHICLE CONTROL
Richard S. Shirley and Lawrence R. Young *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1969 p 435–445 refs Prepared for Mass. Inst. of Tech. (See N70-14876 04-05)
(Grant NSG-577)
Avail: CFSTI CSCL 05H

The human operator's use of roll-angular-motion cues in man-vehicle control is investigated. Extensive data for the human operator's describing function and remnant are taken for a wide range of vehicle dynamics under conditions of visual cues only, roll motion cues only, and simultaneous visual and roll motion cues. Addition of roll motion cues to visual cues permits the human operator to increase his phase lead at frequencies above 2 rad/sec, thereby allowing higher gain and crossover frequency and reduced tracking error. Author

N70-14902*# Boeing Co., Seattle, Wash.
MANUAL CONTROL SYSTEM PERFORMANCE WITH

PREDICTIVE DISPLAYS
John De Shon Warner *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1968 p 449–457 refs (See N70-14876 04-05)
(Contract NASr-54(06))
Avail: CFSTI CSCL 05H

An experimental study of predictive displays was evaluated as a performance aid in a representative manual control task. Predictive information reduced the task complexity to the point where operator performance remained consistent at a high level, though expected variations in task oriented performance criteria were found as a function of several parameters of the controlled element. Author

N70-14903*# Ritchie and Associates, Inc., Dayton, Ohio.
SOME RELATIONS BETWEEN VISUAL AND KINESTHETIC DISPLAYS IN NORMAL DRIVING
Malcolm L. Ritchie *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1968 p 459–463 ref (See N70-14876 04-05)
(Contract PH-86-67-155)
Avail: CFSTI CSCL 05H

Where drivers have a free choice of speeds in curves they choose the speeds in such a way that lateral acceleration is an inverse function of forward velocity. An expression is developed which fits the data in allowing for individual differences in g-levels and a common slope. Author

N70-14904*# Ohio State Univ., Columbus.
STUDIES IN DRIVER-AIDED CAR FOLLOWING
Robert E. Fenton and Charles L. Shaffer *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1968 p 465–479 refs Sponsored by the Ohio Dept. of Highways in cooperation with the Bureau of Public Roads (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

Two studies, involving a kinesthetic-tactile driver aid built into the head of a control stick, were conducted to investigate driver aided car following. Two stick configurations, one front- and one side-mounted, were examined, and tests were conducted on both a well-traveled rural road and an unopened superhighway. The results of these tests and a discussion of the problems involved in stick control of an automobile are contained in this paper. Author

N70-14905*# Puerto Rico Univ., Mayaguez.
AN EXPERIMENTAL STEERING SIMULATOR FOR FARM VEHICLES
C. Saran and C. W. Suggs *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1968 p 481–486 refs Prepared for North Carolina State Univ. (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

Steering of a vehicle can be considered as a problem of manual control systems. With a view to evaluate human performance in the steering of farm vehicles, a steering simulator described in this paper was designed and built. It is the only known attempt in the field. Uniqueness of this simulator lies in that the vehicle itself was disturbed while the target position was fixed. This situation represented a very close simulation of most steered farm vehicles. In most farm vehicles or manually controlled systems the target corresponds to a straight line visualized in a field or some physical object at or near the work area. The disturbances to the vehicle come from the terrain. Author

N70-14906*# Massachusetts Inst. of Tech., Cambridge.
A REVISED STOCHASTIC SAMPLED DATA MODEL FOR EYE TRACKING MOVEMENTS
L. R. Young, J. D. Forster, and N. Van Houtte *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1968 p 489–508 refs (See N70-14876 04-05)
(Grant NSG-577)
Avail: CFSTI CSCL 05H

Our sampled data model is revised by changing the pursuit system to be continuous and proportional to target rate. Transient responses of the model are shown to agree in detail with observed classes of eye movements. Target-synchronized and non-synchronized sampler control logic are compared. Predicted latency distributions of a nonsynchronized sampler with unknown intersample time distribution are analyzed, and saccade synchronized input experiments are compared with predicted mean model responses. The results show properties of both types of sampler control logic. The assets, limitations, and extensions of the model are discussed. The sampled data model proves to be a useful tool for predicting eye response based on target movement only. Author

N70-14907*# Decision Science, Inc., San Diego, Calif.
MODELING THE HUMAN OPERATOR WITH FINITE-STATE MACHINES
Lawrence J. Fogel and Roger A. Moore *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1968 p 509–523 ref (See N70-14876 04-05)
Avail: CFSTI CSCL 05H

Use of finite state machines to represent arbitrary analog transducers and the human operator in his performance of flight control is considered, together with the use of evolutionary programming as a means for finding such representations. A series of tasks of increasing difficulty which demonstrate this capability are presented, ranging from the characterization of relatively simple linear analog "pilots," through more complex nonlinear analog "pilots," and on to the human pilot. Consideration is given to the tradeoff of worth in terms of the adequacy of representation against the resulting complexity of the input and output functions in terms of the size of the alphabet and the complexity of characterization of the logic of the given transducer. The investigation demonstrates that finite state machines do offer a suitable means for representing the human operator in terms of his stimulus response behavior with respect to nonconvergent tracking tasks. Author

N70-14908*# Systems Technology, Inc., Princeton, N.J.
A CLOSED-LOOP NEUROMUSCULAR SYSTEM EXPLANATION OF FORCE DISTURBANCE REGULATION AND TREMOR DATA
R. E. Magdaleno and D. T. Mc Ruer *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1968 p 527–541 refs (See N70-14876 04-05)
(Contract NAS2-2824)
Avail: CFSTI CSCL 05H

An adaptive model has recently been evolved to describe small perturbation operations of neuromuscular actuation systems involved in tracking tasks. This model is compatible with both high quality physiological component data and human operator describing function data of low variability and large dynamic range. The purpose of this paper is to use the model to explain force disturbance regulation data and limb tremor data as closed loop phenomena. This also serves to illustrate a key feature of the model, that the muscle spindles feed back an internal muscle length. Author

N70-14909*# Massachusetts Inst. of Tech., Cambridge.
A DYNAMIC MODEL OF AN AGONIST–ANTAGONIST MUSCLE PAIR
W. H. Vickers and T. B. Sheridan *In* NASA, Washington Fourth Ann. NASA-Univ. Conf. on Manual Control 1968 p 543–549 refs Sponsored in part by NSF (See N70-14876 04-05)
(Grant NsG-107-61)
Avail: CFSTI CSCL 05H

Dynamic and mathematical models are developed for a single muscle and a two-muscle arm system. Equations of motion are determined, and a simple model for constant velocity is

extended to cover general motions. The system is given a feedback loop, and the effects of tension level on the dynamic characteristics of the human controller are discussed. N.E.N.

N70-14932# Florida State Univ., Tallahassee. Computer Assisted Instruction Center.
COMPARATIVE EFFECTS OF ABILITY AND PRESENTATION MODE IN COMPUTER ASSISTED INSTRUCTION AND PROGRAMMED INSTRUCTION
Walter Dick and Raymond Latta 1 Jul. 1969 22 p refs
(Contract N00014-68-A-0494)
(AD-694021; CAI-TM-5) Avail: CFSTI CSCL 5/9

The performance of 64 high and low ability students was compared on an instructional sequence in (significant figures,) a mathematical concept, which was presented via programmed instruction and computer-assisted instruction. The programmed test consisted of 52 linear frames. The CAI program which was presented on a cathode-ray tube terminal (CRT) had the same basic frames plus remediation for incorrect responses as well as remedial loops. The results on a posttest, retention test, and learning errors, indicated that high ability students performed better than low ability students; students using PI performed significantly better than those using CAI, and in each case there was a significant ability by treatment interaction. The observed differences are attributed to the very poor performance of the low ability students who used the CRT terminal. It is suggested that low ability students may require hard copy memory aids to supplement CAI learning experiences. Author (TAB)

N70-15022*# Wilson (B.) and Co., Inc. Hartford, Conn.
HANDBOOK OF GARMENT SELECTION CRITERIA FOR A SPACE STATION
Austin C. Morris [1968] 161 p
(Contract NAS9-9563)
(NASA-CR-102051) Avail: CFSTI CSCL 06K

With the flights of Mercury, Gemini and Apollo, the clothing of the flight crew members was selected on the basis of the immediate needs of the particular mission. Since the crews and mission lengths involved were relatively small, there was little impact in the selection of the garments of the crews. As the mission lengths increase and crew sizes grow in number, it is apparent that the penalty of the clothing and related systems of the crew members will no longer be negligible and will require investigation. The purpose of this handbook is to present the criteria by which a garment may be evaluated for use in a space station. It is not intended for use as the absolute criteria for design; rather, it is to familiarize persons of engineering discipline with the steps and rationale involved. Author

N70-15047*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
LIFE SUPPORT IN UNUSUAL ENVIRONMENTS Semiannual Status Report
L. R. Young Nov. 1969 10 p refs
(Grant NGR-22-009-312)
(NASA-CR-107451; MVLS-69-3; SASR-3) Avail: CFSTI CSCL 06K

Survey reports on atmospheres in life support, extravehicular, and water recovery systems are summarized. A literature survey on contaminant monitoring is cited. Areas of investigation under atmospheres in life support systems are storage of atmospheric gases, regenerative carbon dioxide removal systems, carbon dioxide removal in space suits, recovery of oxygen, and electrolysis of water. Subsystems of life support, power, communications, propulsion guidance, and stabilization are problem areas mentioned under extravehicular systems. Problems covered under water recovery systems include recovery requirements, potability, monitoring equipment, and recovery techniques for spacecraft recovery. Problem areas are recommended for graduate school research. J.M.C.

N70-15131*# Astro Research Corp., Santa Barbara, Calif.
ANALYSIS OF LARGE BENDING DEFORMATIONS OF A FILAMENTARY TUBULAR SHELL TYPICAL FOR PRESSURE CONSTRAINT COMPONENTS OF SPACE SUITS
Odus R. Burggraf Washington NASA Jan. 1970 51 p refs
(Contract NAS7-728)
(NASA-CR-1507; ARC-R-331) Avail: CFSTI CSCL 06K

A theory is formulated for the bending deformation of a cylindrical, pressurized fiber shell. This type of structure is for pressure constraint components of space suits. The filament wound and linked fiber tube are considered in the postslip phase of bending, although any type of knots or fixed fiber nodes are permitted in the preslip phase. Inextensible fibers are assumed. Analytical formulas are derived for the bending stiffness in the range of small deformations, and numerical results are obtained for large deformations. The idealized frictionless fiber tube is unstable in bending. For the friction stabilized tube the effect of the variable mesh parallelogram in the preslip phase is to produce a wide linear range followed by a relatively flat moment characteristic for large bending angles. The effect of fiber slippage is to produce a rapid reduction of the bending moment required for deformation with ultimate destabilization as the bending angle increases. Author

N70-15416# Mitre Corp., Bedford, Mass.
STUDIES IN DISPLAY LEGIBILITY
C. V. Riche, Jr. and G. C. Kinney *In* AGARD Displays for Command and Control Centers Jul. 1969 p 93–103 refs (See N70-15408 04-08) Avail: CFSTI

The subject of this chapter is data display legibility and its related problems. It reports on work done on a new form of display specifications. The most unusual part of this form is a section on legibility testing procedure and acceptance standards for human performance. The newer specification overcomes several disadvantages of the conventional form which specifies only geometric and photometric properties of display details. This form has several advantages of its own which help it to accomplish all of the purposes of a display specification, and it shows promise for better displays in the future. Author

N70-15499*# California Univ., Berkeley. Space Sciences Lab.
FUNCTIONAL CONTRIBUTIONS OF BOOTLEGGING AND ENTREPRENEURSHIP IN RESEARCH ORGANIZATIONS
Todd R. La Porte and James L. Wood Sep. 1969 33 p refs
Its Internal Working Paper 106
(Grant NGL-05-003-012)
(NASA-CR-107353) Avail: CFSTI CSCL 05K

Two activities used by professional scientists to alter their immediate work situation are discussed within the framework of organizational demands. Bootlegging consists of engaging in research projects not formally specified in the contract or grant funding the organizational work. Entrepreneurial activity is the attempt to gain resources for the researcher's project. Both activities permit the satisfaction of personal goals within the constraints of large organizations. Data collected from an industrial research laboratory, a nonprofit university laboratory, and a military defense laboratory were analyzed. The hypothesis that these activities contribute positively to problem solving in research organizations was supported. Both activities contributed most clearly to organizational integration, that is, cooperative relationships, by reducing role strain in scientists and role conflict between scientists and managers. Bootlegging and, to a lesser extent, entrepreneurship seemed to contribute to adaptation and goal attainment, and least to latent value maintenance. Opportunities to engage in either activity seemed to result in higher levels of professionally valued experience. M.H.E.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-14107# Air Force Systems Command, Wright-Patterson AFB, Foreign Technology Div.
RATE OF ABSORPTION OF OXIDES OF NITROGEN BY NITRIC ACID AT A PRESSURE OF 1.2 KG/SQUARE CM
V. I. Konvisar et al 26 Mar. 1969 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk Tadzh. SSR, Otd. Fiz.-Tekh. Khim Nauk (Dushanbe), no. 1, 2, 3, 1967 p 71–79
(AD-694938; FTD-HT-23-1178-68) Avail: CFSTI CSCL 7/4

Results are presented of the effect of various physicochemical and hydrodynamic factors on the process rate of absorption of nitrogen oxides by nitric acid solutions in a foam apparatus. With an increase in the initial nitrosity of the gas, the degree of conversion of nitrogen oxides into HNO3 increases. The degree of conversion of nitrogen oxides into HNO3 is reduced with an increase in nitric acid concentration, while efficiency remains practically constant right up to 45 percent nitric acid with the same concentration of nitrogen oxides. In the case of counterflow the efficiency increases with a growth in the concentration of nitrogen oxides and nitric acid. With a certain motivating force of the absorption process, it is necessary to take into account the equilibrium pressure of the nitrogen oxides over the liquid phase. With an increase in temperature from 20 to 50 degrees C, the coefficient of the degree of achievement of equilibrium between the nitrogen oxides and the acid, or efficiency, is reduced by 0.2 percent per 1 degree C. An increase in temperature within the limits 20-50 degrees C renders in a negative influence on the absorption process. Author (TAB)

N70-14141# Faraday Labs., Inc., La Jolla, Calif.
GAS-SURFACE INTERACTIONS Annual Report, 30 Sep. 1968–1 Oct. 1969
D. Mc Keown, J. M. Bowyer, Jr., and R. S. Dummer Oct. 1969 53 p refs
(Contract N00014-68-C-0373)
(AD-695060; F-16-69) Avail: CFSTI CSCL 7/4

The report is divided into three parts. The first part describes current laboratory studies of particle impacts on surfaces. Experiments are being made using a molecular beam source capable of generating ion and neutral beams at energies up to 5 keV. A quartz crystal microbalance and energy transfer probe were used to measure interactions of the beam with surfaces. Results of the thermal analysis of the energy transfer probe and measurements made on the transfer of energy and sputtering of Al and Au in Ne(+) and Ar(+) are presented. The second part is a paper entitled Sputtering at Satellite Altitudes. The paper shows how it is possible to determine the displacement energies of surface atoms from sputtering yield measurements. The third part of the report is a paper entitled Gas-Surface Energy Transfer Experiment for OGO-F. The work describes the application of laboratory instrumentation to the direct measurements of gas-surface interactions in space. Author (TAB)

N70-14157# Maryland Univ., College Park. Dept. of Chemistry.
PHOSPHOROUS COORDINATION COMPOUNDS Final Technical Report
Samuel O. Grim 2 Jun. 1969 28 p refs
((Grant AF-AFOSR-782-67)
(AD-695102; AFOSR-69-2474TR) Avail: CFSTI CSCL 7/2

The report includes list of personnel and publications resulting from research on phosphorus coordination compounds. Brief abstracts are given. Research emphasized phosphorus-31 magnetic resonance spectra of coordination compounds of chromium, molybdenum, and tungsten carbonyls; and platinum, palladium, rhodium, iridium and mercury halides. Phosphorus-heavy metal nuclear spin-spin couplings are described for mercury-199, tungsten-183, platinum-195, and rhodium-103. The magnitude of these couplings are related to current bonding theory. Author (TAB)

N70-14170# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF THE CHEMICAL STRUCTURE OF HYDROCARBONS ON THEIR THERMAL OXIDATION STABILITY
A. V. Lozovoi et al 26 Mar. 1969 10 p refs Transl. into ENGLISH from Khim. Tverd. Topl. (Moscow), no. 2, 1967 p 66–69
(AD-694800; FTD-HT-23-1236-68) Avail: CFSTI CSCL 7/3

A study was made of the thermal oxidation stability of 17 individual hydrocarbons boiling in the range 138.5-287C; it included a series of n-paraffins, monocyclic six-member cyclenes, bicyclic condensed and uncondensed naphthenes, tricyclic condensed naphthenes, and monocyclic aromatic hydrocarbons. A dependence of reactivity of the studied hydrocarbons on their chemical structure in thermal oxidation processes was demonstrated. Author (TAB)

N70-14190# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW FERROCENE-CONTAINING POLYMERS
T. A. Sokolinskaya et al 3 Jan. 1969 9 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. Ser. B (Moscow), v. 9, no. 3, 1967 p 237–240
(AD-695236; FTD-HT-23-1371-68) Avail: CFSTI CSCL 7/3

Five new ferrocene-containing polymers were obtained by joint polycombination of ferrocene with naphthalene, azobenzene, pthalic anhydride, benzoic acid, benzophenone, aminoazobenzene, alpha-napthylamine. Their properties were studied, and the influence of surface absorption of the semiconductor properties of the copolymer of ferrocene and phthalic anhydride was clarified. Author (TAB)

N70-14212# Technische Hogeschool, Eindhoven (Netherlands).
PHYSICOCHEMICAL INVESTIGATIONS AND ELECTRICAL CONDUCTIVITY MEABUREMENTS ON MONOCRYSTALLINE GALLIUM SULPHIDE
Ronald Maurits Andre Lieth (Ph.D. Thesis) 14 Oct. 1969 116 p refs
Avail: CFSTI

The transport properties of gallium sulfide were investigated by studying the physicochemical properties including: (1) preparation of polycrystals with low impurities, (2) phase equilibria in the Ga-S system, (3) stability at high temperature, and (4) preparation of single crystals. The specific dark conductivity as a function for both n- and p-type crystals is discussed. It is concluded that further research is required for improvement of purity, detection, and diffusion in gallium sulfide. F.O.S.

N70-14229# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF MIXED FULL AND SEMIESTERS OF PHOSPHOROUS ACID AS ORGANIC MOTOR OIL ADDITIVES
I. M. Orudzheva, Sh. M. Novruzov, A. A. Vagabova, and S. A. Resulova 10 Apr. 1969 7 p refs Transl. into ENGLISH from Azerb. Khim. Zh., (Russian), no. 5, 1967 p 47–49
(AD-694803; FTD-HT-23-1360-68) Avail: CFSTI CSCL 7/3

The synthesis of mixed full and semiesters of phosphonic acid was effected using alkylphenols produced by the chemical industry. By condensation of acid chlorides of dicyclohexyl-, di-(2-methylcyclohexyl)-, 2-isopropyl-4-oxyphenyl- and 2,5-di-tert-butyl-4-oxyphenylphosphorous acid with an industrial alkylphenol or the condensation of acid chloride of di-(alkylphenyl)-phosphorous acid with diethylamine, the corresponding mixed full and semiesters of phosphorous acid are obtained. The yield of reaction products is 70-80% Phosphorous content in the obtained phosphites varies from 5-7%. The obtained products are viscous substances of a bright yellow color, well soluble in organic solvents and mineral oils suitable for motor oil additives. Author (TAB)

N70-14239# Air Force System Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
OPPOSED TENDENCIES IN THE MECHANISM OF OXIDATIVE DEGRADATION OF POLYMERS
M. B. Neiman 19 Mar. 1969 23 p refs Transl. into ENGLISH from Khim. Kinetika Tsepnye Reaktsii, (Moscow), 1966 p 409–430
(AD-694922; FTD-HT-23-643-68) Avail: CFSTI CSCL 7/4

A discussion and analysis of the published data on mechanism of oxidative decomposition of polymers supports Semenovas chain-reaction theory Chemical Abstracts 25 (5992) with respect to degenerated branching, occurring as inhibition of polymer oxidation reactions. The discussion points to an increased degree of probability of oxidation initiation by anti-oxidants and of a secondary critical concentration of antioxidants. Author (TAB)

N70-14254# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
HIGH SENSITIVITY ATOMIC ABSORPTION SPECTROSCOPY VIA CONTINUOUS SAMPLE PRECONCENTRATION. PART 2: CONTINUOUS SOLVENT EXTRACTION
J. P. Mislan and S. Elchuk Jun. 1969 14 p refs
(AECL-3431) Avail: CFSTI CSCL 07D

This report describes an evaluation of continuous solvent extraction as a preconcentration technique for sensitivity enhancement of continuous atomic absorption measurements. Continuous preconcentration by evaporation was investigated in the first part of this study. A simple automated solvent extraction system has been developed which can be quickly attached to any atomic absorption spectrophometer to give a 100–200 fold sensitivity enhancement. Author

N70-14261# National Bureau of Standards, Washington, D.C. Spectrochemical Analysis Section.
ACTIVITIES OF THE NBS SPECTROCHEMICAL ANALYSIS SECTION, JULY 1968 TO JUNE 1969
Bourdon F. Scribner, ed. Dec. 1969 112 p refs
(NBS-TN-502) Avail: SOD $1.00

Spectrochemical research activities, improvements in equipment, and applications are summarized. In optical emission spectrometry micro methods were investigated and computer programs were completed for fitting analytical curves. In electron probe microanalysis studies of corrections for quantitative analysis and new gains in nondiffractive analysis and target current scanning were made. X-ray absorptiometry was applied to the analysis of thin metal foils and computer programs were improved for correction of X-ray fluorescence analysis. Resolution of the mass spectrometer was improved and the behavior of ion samples was studied. Extensive involvement in the standard reference materials program contributed to certification of several SRM's including high purity Zn and Au, two sets of wires, Au–Ag and Au–Cu, for microprobe analysis, and electronic and magnetic alloys. Author

N70-14277# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS AND INVESTIGATION OF THE EFFECT OF CERTAIN MERCAPTALS ON MOTOR OIL PROPERTIES
A. M. Kuliev et al 3 Apr. 1969 7 p refs Transl. into ENGLISH from the Russian
(AD-694754; FTD-HT-23-1355-68) Avail: CFSTI CSCL 11/8

Oil additives with functional groups containing oxygen, phosphorus or nitrogen are active only to about 200 degrees C. To obtain oil additives effective above that temperature, compounds with low valence sulfur must be used. The effectiveness of these compounds depends on the organic moiety. With this in mind, the authors studied mercaptals made from furfural and benzaldehyde. TAB

N70-14311# California Univ., Livermore. Lawrence Radiation Lab.
THE THERMOLUMINESCENT EMISSION SPECTRUM OF LiF
C. R. Wilson and D. E. Jones *In its* Hazards Control Dec. 1968 p 1–5 Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

The thermoluminescent emission spectra of highly purified LiF were found to peak at 590 nm, while regrown crystals of this material were found to have their maximum emission shifted to shorter wavelengths near 400 nm. Author (NSA)

N70-14316# California Univ., Livermore. Lawrence Radiation Lab.
PARAROSANILINE CYANIDE FOR HIGH-LEVEL DOSIMETRY
E. N. Sanborn *In its* Hazards Control Dec. 1968 p 25–34 Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

A method that uses pararosaniline cyanide to make a calorimetric dosimeter for measuring x and gamma radiation in the megaroentgen range is described. Author (NSA)

N70-14318# California Univ., Livermore. Lawrence Radiation Lab.
THE EFFECT OF HALOGEN COMPOUNDS ON THE MOLECULAR SPECTRA OF AIR
G. O. Nelson *In its* Hazards Control Dec. 1968 p 38–46 Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

Airborne halogen compounds were found to greatly increase the intensity of N2 and NO molecular spectra of air in an ac spark. This phenomenon was used to measure the presence of many volatilized halogen compounds present in concentrations as low as 1 ppM. Author (NSA)

N70-14332# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF SUBSTITUENTS ON REACTIVITY OF THE IRON ATOM IN FERROCENE DERIVATIVES
E. G. Perevalova et al 8 Apr. 1969 15 p refs Transl. into ENGLISH from Tr. Konf. po Probl. Primeneniya Korrelyatsion. Uravnenii v Organ. Khim., Tartusk. Gos. Univ. (Tartu), v. 2, 1963 p 26–39
(AD-695332; FTD-HT-23-1460-68) Avail: CFSTI CSCL 7/3

The Redox potentials of 60 monosubstituted ferrocene derivatives were determined by means of potentiometric titration. The corresponding logarithms of equilibrium constants were correlated to the values of Hammetts and Tafts constants. The interaction of some substituents with the Fe-atom is interpreted in terms of field-effect. Author (TAB)

N70-14372# Japan Atomic Energy Research Inst., Tokyo.
AUTOXIDATIONS OF BENZENE AND TOLUENE IN THE AQUEOUS PHASE
Hiroshi Hotta Jun. 1969 56 p refs In JAPANESE; ENGLISH summary
(JAERI-1185) Avail: CFSTI

Autoxidations of benzene and toluene in the aqueous phase have been studied since 1958, and the results have been published. It is attempted to summarize those already published results and to clarify the whole scheme of the research. Benzene or toluence was not oxidized in water up to 200 C even under the pressurized oxygen atmosphere, while it was oxidized to phenol or benzaldehyde in the presence of some metal salt. The relationships between the yield of the product and the reaction conditions, that is, gamma ray irradiation, reaction temperature, the kind of metal salts, the concentration of sulfuric acid, and so on, were clarified. Ethylbenzene was also studied by the same way. On the other hand, the reaction mechanism was confirmed by studying the properties of metal salts in the aqueous phase, the isotope effect of hydrogen on the autoxidation, and the process of the formation of the product by

using oxygen 18. Furthermore, the binary systems of benzene or toluene, containing various organic additives, were studied and tried to be analysed kinetically. Author

N70-14376# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN PLASTICIZING PECULIARITIES OF POLYVINYL CHLORIDE FILMS OBTAINED FROM SOLUTIONS

S. S. Slavnova and V. M. Chesunov 31 Jan. 1969 9 p Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii. Tekhnol. Legkoi Prom. (USSR), no. 1, 1967 p 69–73

(AD-694774; FTD-HT-23-700-68) Avail: CFSTI CSCL 11/9

It appears most probable that the vibrations of the polymer-molecule carbon skeleton interact in the 1000-1200/cm range with vibrations of the C-C groups present in the plasticizers (DBP and glycerine). Plasticizer dibutyl phthalate (DBP) molecules present in the films contain a carbon chain with less inhibited internal rotation than the polymer molecules, which are cohesively bound into micelles. Hence, the low-intensity band of one C-C valence vibration (1111/cm of the polymer carbon chain is absorbed by two bands (1070 and 1150/cm), which reflect two valence vibrations of the more flexible plasticizer molecule. This is confirmed by the fact that the band intensity rises with increasing plasticizer concentration. The most conspicuous intensity increase of these bands is observed when films are formed from solutions in dichloroethane (DCE). This is because DCE, a poor solvent for PVC by comparison with cyclohexane, lowers the degree of intramicellar plasticizing. The concentration of plasticizer molecules not bound to the polymer then increases, with the result that the intensities of the corresponding bands in the IR spectrum also increase. Author (TAB)

N70-14398# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure.

SOME APPLICATIONS OF HIGH VOLTAGE ELECTRON MICROSCOPY

K. F. Hale and M. Henderson Brown Sep. 1969 27 p refs (NPL-IMS-4) Copyright. Avail: CFSTI

Methods of determining penetration curves are described and the curves given for iron, tungsten, cement and glass. The gain in penetration compared with 100 kV is about 3:1 at 500 kV and between 5 and 6:1 at 1 MV. The extra penetration will allow many investigations at high accelerating voltages which would otherwise be difficult or even impossible by 100 kV electron microscopy, and examples are given for both metals and nonmetals. Author

N70-14406# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF CERTAIN FERROCENE DERIVATIVES ON POLYETHYLENE FILM DURING IRRADIATION BY UV LIGHT

Z. A. Beinoravichute 26 Mar. 1969 9 p refs Transl. into ENGLISH Vsesoyuznyi Simpozium Po Voprosam Proizv. Trub i Detalei Truboprovodov Iz Polietilena, Materialy (Vilna), 1966 p 125–129

(AD-695208; FTD-HT-23-1232-68) Avail: CFSTI CSCL 7/5

Investigated are ferrocenes for possible use as light-stabilizers of polyethylene. In order to clarify the possibility of using certain ferrocene derivatives to stabilize polyolefin films against the effect of UV radiation, the stabilized films have been subjected to UV. In this work ferrocenes containing benzoyl, acetyl, and alkyl groups were investigated. The course of light aging of the polyethylene films was determined according to the change in carbonyl group content (by IR absorption spectra) and also in terms of solubility and quantity of insoluble gel. Author (TAB)

N70-14433# Oak Ridge National Lab., Tenn.

CHEMICAL PROPERTIES OF CALIFORNIUM-252(1,2)

R. D. Baybarz *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 131–149 refs Sponsored by AEC (See N70-14429 04-24) Avail: CFSTI

Some chemical properties of the transplutonium elements are described, from which chemical flow sheets may be designed for isolation and purification of these elements. Methods for separation of actinides from rare earths are considered. An anion exchange method for separation of californium is described along with the Tramex process. NSA

N70-14468# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN RESULTS OF X-RAY SPECTRAL INVESTIGATION OF THE CHEMICAL BOND IN VARIABLE COMPOSITION (TI-TIO SUB 0.48) TITANIUM OXIDES

E. Ye. Vainshtein et al 12 May 1969 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Sibir. Ser. Chim. Nauk (Moscow), no. 3, 1966 p 12–16

(AD-695916; FTD-HT-23-989-68) Avail: CFSTI CSCL 20/2

The structure of x-ray absorption and emission of Ti in the lower oxides in a specific composition was investigated under analogous experimental conditions; in this composition range, a continuous series of solid solutions of O in alpha Ti exists. The general structure of the Ti spectra in the metal and the oxides with varying O content remains almost the same, although the variations in the relative intensity of the lines and in the fluctuations of the absorption coefficient in K edges attain significant values. The closeness in Ti-Ti and Ti-O spacings for both hexagonal and cubic Ti oxides accounts for the similarity in their different lattice symmetry. A possible theoretical interpretation of the maximum of the fine structure on the x-ray spectrum is presented. Author (TAB)

N70-14471# Brandeis Univ., Waltham, Mass.

MAGNETIC AND OPTICAL STUDIES OF CUBIC SINGLE CRYSTALS CONTAINING 4D AND 5D IONS Final Technical Report, 1 Jun. 1966–1 Jun. 1969

Paul B. Dorain Wright-Patterson AFB, Ohio ARL Jun. 1969 168 p refs

(Contract AF 33(615)-5228)

(AD-695051; ARL-69-0088) Avail: CFSTI CSCL 7/4

The optical spectra of Os(+4) and Ru(+4) in single cubic crystals of K2PtCl6 and Ca2ZrCl6 at 4.2 degrees K is reported. The results are analysed in terms of a complete d4 intermediate coupling scheme. Magnetic susceptibilities were calculated and the magnetic moments for all excited states were calculated. A report on a calculation of the intensities for these materials is included. Tables of wavefunctions and magnetic moments for the d4 system are given. Author (TAB)

N70-14475# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MIGRATION POLYMERIZATION OF PHENYLPHOSPHINE WITH DIISOCYANATES AND VARIOUS COMPOUNDS WITH TWO DOUBLE BONDS

A. N. Pudovik et al 3 Apr. 1969 11 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. (Moscow), v. 9, no. 10, 1967 p 2241–2245

(AD-695354; FTD-HT-23-1456-68) Avail: CFSTI CSCL 7/3

The migration polymerization of phenylphosphine with 2,4-methylphenylene and hexamethylenediisocyanates, dimethacrylates of ethylene- and 1,2-propyleneglycols, dibenzylidene of m- and p-phenylenediamines, diallylamine was studied as was their behavior. Author (TAB)

N70-14487# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Plasma Physics Research Lab.

STARK BROADENED PROFILES OF THE HYDROGEN LINES H ALPHA AND H GAMMA AS A FUNCTION OF TEMPERATURE AND DENSITY

Michael E. Bacon and David F. Edwards Jul. 1969 29 p refs Prepared jointly with Colorado State Univ.

(AD-695055; ARL-69-0109) Avail: CFSTI CSCL 7/4

The Stark-broadened line profiles of the H(alpha) and H(gamma) lines of hydrogen are tabulated as a function of density

and temperature. Lower state broadening is considered and the Lorentz-Weisskopf estimate for the strong collisions is included in the free-electron impact broadening operator. The halfwidths given by these profiles are within the experimental errors of the measured values. Author (TAB)

N70-14509# Lobo (Walter E.), New York.
ACETYLENE AND LOW COST POWER
Walter E. Lobo *In* AEC Abundant Nucl. Energy May 1969 p 83–92 refs (See N70-14504 04-22)
Avail: CFSTI

The various processes for the manufacture of acetylene are briefly reviewed with particular emphasis on those processes that use electrical energy as the main energy source. The cost of energy, although important, is not considered a large enough factor that low-cost power would revolutionize the acetylene-production picture. Author (NSA)

N70-14510# Abcor, Inc., Cambridge, Mass.
THE FIXATION OF NITROGEN IN ARC PROCESSES
R. S. Timmins *IN* AEC Abundant Nucl. Energy May 1969 p 93–105 (See N70-14504 04-22)
Avail: CFSTI

The availability of cheap electrical energy would open the way to use of the electric-arc process for direct fixation of nitrogen from the air. Two approaches to a process are discussed. The frozen equilibrium method utilizes rapid quench to retain the nitric oxide present in an equilibrium mixture of oxygen and nitrogen at high temperature. On the basis of past experiment and thermodynamic calculation, conditions of pressure, temperature, and composition, which minimize the electrical energy requirements, are presented. The second approach involves the generation by an arc of active species, which subsequently reacts to form nitric oxide. Both thermal and cold discharges are discussed. The economics of the process is very strongly controlled by the electrical energy requirements for formation of nitric oxide. Rough cost estimates show that the requirement must be in the neighborhood of 2 to 4 kw-hr/lb of NO. Author (NSA)

N70-14511# Oak Ridge National Lab., Tenn.
THE ECONOMICS OF HYDROGEN AND OXYGEN PRODUCTION BY WATER ELECTROLYSIS AND COMPETITIVE PROCESSES
J. E. Mrochek *In* AEC Abundant Nucl. Energy May 1969 p 107–122 refs (See N70-14504 04-22)
Avail: CFSTI

The manufacturing costs of hydrogen and oxygen are estimated for water-electrolysis plants using two types of advanced electrolytic cells; porous-electrode cells and high-temperature vapor-phase cells. Electrolytic plants producing 40 million standard cubic feet of hydrogen and 860 tons of oxygen per day are compared with fossil-fuel plants that use steam reforming and partial-oxidation processes at the same hydrogen-production rates. The cost of electricity required for the electrolytic process using a porous-electrode cell to break even with the fossil-fuel processes ranged from 0.8 to 2.3 mills/kw-hr. If an oxygen credit of $4/ton was assumed, this break-even power cost range increased to 1.5 to 3 mills/kw-hr. The use of electrolytic hydrogen plants as load-leveling devices for power plants is discussed briefly. Author (NSA)

N70-14520# Oak Ridge National Lab., Tenn.
MARINE CHEMICAL RECOVERY
W. C. Yee *In* AEC Abundant Nucl. Energy May 1969 p 249–268 refs (See N70-14504 04-22)
Avail: CFSTI

An economic analysis was made of several possible salt complexes that recover chemicals from the brine discharge of a nuclear desalination plant producing 1000 Mgd of fresh water with a seawater concentration factor of 2. Primary product recovery involves using solar energy at an arid desert site to separate out sequentially gypsum, salt, potash, and magnesium chloride by fractional crystallization. Secondary product production involves using electrical and steam energy from the desalination plant to obtain cement and sulfuric acid, caustic soda and chlorine, and magnesium metal. Caustic soda and chlorine (as hydrochloric acid) can be used to remove bicarbonate ions from seawater prior to fresh-water production. Land requirements for solar evaporation are reduced by the availability of evaporator effluent as a starting material. Seawater treatment by the NaOH-HCl method would compete with the conventional sulfuric acid method of treatment at a power cost of 4 mills/kw-hr when sulfur costs $50/ton. Author (NSA)

N70-14521# Ionics, Inc., Watertown, Mass.
POTABLE WATER FROM SEAWATER BY HIGH TEMPERATURE ELECTRODIALYSIS
W. A. Mc Rae *In* AEC Abundant Nucl. Energy May 1969 p 269–298 refs (See N70-14504 04-22)
Avail: CFSTI

Electrodialysis plants that can produce hundreds of millions of gallons daily are considered. The nature of ion-exchange membranes, the process and apparatus, and some of the results obtained at high temperature in the laboratory are discussed. A brief economic analysis of high-temperature electrodialysis plants integrated with large electric power stations is presented. Static tests on membranes at high temperatures show that thermal decomposition of the ion-exchange resin per se will probably not be a serious problem in practical apparatus. The electric resistances of both membranes and saline water are shown to decrease at a compound rate of about 1% per degree Fahrenheit, and current efficiency is found to be essentially invariant with temperature. Costs are estimated for producing 205 Mgd of fresh water from seawater and from brackish water in high temperature electrodialysis plants integrated with steam-turbine generators. Author (NSA)

N70-14558# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF AN ELECTRIC FIELD ON THE STRUCTURE OF NONAQUEOUS DISPERSION SYSTEMS WITH ANISODIAMETRIC PARTICLES
Yu. F. Deinega et al 26 Mar. 1969 15 p refs Transl. into ENGLISH from Konf. po Fiziko-Khim. Mekhan. Poristykh i Voloknistykh Dispersnykh Struktur i Materialov (USSR), 1967 p 147–154
(AD-695212; FTD-MT-24-454-68) Avail: CFSTI CSCL 11/8

The behavior of soap lubricants and soap suspensions in hydrocarbon media in the presence of an applied electric field was investigated, with the effect produced by the electric field observed in polarized light. It was found that the application of an electric field up to 15 kv/cm produced a kind of flocculation in the suspension, viz: the suspended material became concentrated at one electrode and the suspension medium at the other electrode. Reversal of current direction produced a corresponding reversal of the effect. The applied electric field also produced some structural order in the suspension, and the ordering effect of the field was enhanced by the addition of surface-active agents such as a 50 percent solution of barium dialkyldithiophosphate in mineral oil. Photographs of the suspension in various stages of electrolysis are presented. A mechanism for the observed phenomena in terms of dipole ordering and dipole discharge by the applied field is proposed. It is concluded that further studies on the effect of electric fields applied to hydrocarbon media should prove interesting. TAB

N70-14563# New York Univ., N.Y.
THEORETICAL INVESTIGATION ON THE CHANGES OF SHAPE APPEARING IN ELECTRONICALLY EXCITED MOLECULES: STUDY OF THEIR ROLE IN REACTION MECHANISM Final Report, 30 Sep. 1965–31 Dec. 1968

Louis Burnelle 15 Sep. 1969 8 p refs
(Grant DA-ARO(D)-31-124-G718)
(AD-693880; AROD-5963-16-C) Avail: CFSTI CSCL 7/4

The report presents a brief summary of a project primarily concerned with the geometry of polyatomic molecules in their ground and their excited states. An essential part of the project was the calculation of potential curves and surfaces, and an investigation of the adequacy of various methods for achieving this end. On the basis of the resulting surfaces, spectroscopic and chemical properties of the systems studied were investigated. A side aspect of the work was a study of the charge density distributions. The wave functions obtained for a series of the radicals have also been used to compute quantities related to esr spectroscopy. Two distinct lines of approach were followed: semiempirical methods were used dealing with large systems, or in exploratory studies of small molecules. The report deals successively with these two types of procedures. Author (TAB)

N70-14602# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CORRELATION ANALYSIS OF CHEMICAL SHIFTS OF PROTONS IN CYCLOPENTADIENYL RINGS IN THE SPECTRA OF MONOSUBSTITUTED FERROCENES

G. G. Dvoryantseva et al 19 Mar. 1969 13 p refs Transl. into ENGLISH from Reaktsionnaya Sposobnost Organ. Soedin., Tartusk. Gos. Univ. (Tartu), v. 3, no. 3, 1966 p 86–87
(AD-695319; FTD-HT-23-1180-68) Avail: CFSTI CSCL 7/4

The chemical shifts of PMR for several substituted ferrocenes in CCl4 and DCCl3 have been measured. The substituted groups included the following: COCH3, COC3H7, COOH, COOCH3, CONH2, CN, SO2, SO2C6H6, OCOCH3, Cl, Br, I. The correlations of the PMR chemical shifts obtained with resonance and inductive substituent constants are discussed. Author (TAB)

N70-14605# Case Western Reserve Univ., Cleveland, Ohio. Ultrasonics Research Lab.

ULTRASONIC ABSORPTION IN ELECTROLYTIC SOLUTIONS

Le Roy G. Jackopin and Earnest Yeager 15 Jun. 1969 200 p refs
(Contract Nonr-1439(04))
(AD-694508; TR-35) Avail: CFSTI CSCL 7/4

The kinetics of fast reactions in solution have been studied by means of ultrasonic relaxation techniques. The rate constants for a simple ionization-association process (acetic acid) were determined from ultrasonic absorption measurements and found to compare favorably with those evaluated by other methods (Wien effect II, electrochemical). Ultrasonic relaxation has been re-examined in a 2-2 electrolyte (MnSO4) in order to resolve discrepancies in published data. The new results are in good agreement and complement data recently published by the ultrasonic groups at Gottingen and Heidelberg. A non-linear regression technique developed as part of the present research, has been used to analyze these data. Two relaxation frequencies are adequate to describe these data if the non-relaxing absorption component is treated as an adjustable parameter (in contrast to the three or four relaxation frequencies reported earlier by other groups). Ultrasonic relaxation has also been studied in CdI2 solutions and compared with NMR data. Author (TAB)

N70-14635# Harvard Univ., Cambridge, Mass. Dept. of Chemistry.

THE OXIDATION OF CARBON DIOXIDE MONOXIDE BY OXYGEN IN SHOCK WAVES

A. M. Dean and G. B. Kistiakowskiy Sep. 1969 36 p refs Submitted for publication
(Contract Nonr-1866(36))
(AD-694515) Avail: CFSTI CSCL 7/4

The oxidation of CO, with and without small amounts of added hydrogen, was investigated in very dilute mixtures with argon. The reaction was followed in incident shock waves by measuring CO and CO2 infrared emissions for about 2000 micro sec particle time over the 1700 to 2300K range. The reaction shows an initially increasing (exponentially in many runs) rate followed, under most conditions, by a period of constant rate. The observed CO2 concentration - time profiles were compared to those calculated numerically on a computer. These calculations used two mechanisms, proposed by others, for the shock tube oxidation of CO. The level of impurities in gases used was extensively investigated. Relation of the presently reported data to those of others is discussed. Author (TAB)

N70-14636# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ALUMINUM BORIDES

V. A. Neronov 20 May 1969 70 p refs Transl. into ENGLISH from Russian Publ. "Alyminiya Boridy" Novosibirsk, Nauka, 1966 p 3–70
(AD-695910; FTD-HT-23-1214-68) Avail: CFSTI CSCL 7/2

A systematization and generalization of all available data on aluminum borides, including properties, production methods and uses, detailing elemental boron, the aluminum-boron system, aluminum-boride production, the experimental investigation of the process of aluminothermal production of AlB12, and multicomponent systems with participation of boron and aluminum. Specific discussions include use of aluminum-boron compounds in the field of semiconductors and abrasives. Author (TAB)

N70-14643# Harvard Univ., Cambridge, Mass. Dept. of Chemistry.

CALCULATION OF CONCENTRATION-TIME PROFILES IN SHOCK WAVES AND THE APPLICATION OF THIS METHOD TO THE OXIDATION OF CARBON MONOXIDE

A. M. Dean Sep. 1969 30 p refs
(Contract Nonr-1866(36))
(AD-694514) Avail: CFSTI CSCL 7/4

The report describes a computer program which calculates concentration-time profiles behind incident shock waves by numerically integrating the system of rate equations. The use of this program to investigate the kinetics of carbon monoxide oxidation is also considered. A mechanism and values for the associated rate constants which formally describe the initial rates in a 2% CO - 1% O2 - 97% Ar mixture between 1700 -2300 K is given. Author (TAB)

N70-14644# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.

LIGHT SCATTERING OF HYDRODYNAMICALLY DEFORMED MACROMOLECULES

Noor Ahmad, Wilfreid Heller, and Masayuki Nakagaki 10 Jul. 1969 8 p refs Submitted for publication
(Contract Nonr-3511(00))
(AD-694521; TR-18(64)) Avail: CFSTI CSCL 7/4

It had been pointed out several years ago that light scattering in flowing systems should allow one to determine the shape of rigid macromolecules and rigid submicroscopic particles and the degree of hydrodynamic deformation of flexible macromolecules. The light scattering increment expected on flow of the former type of systems was verified some time ago for aqueous solutions of tobacco mosaic virus and for aqueous dispersions of colloidal crystals. In extensive experiments thg effect was verified also for the second type of systems. The present preliminary communication is concerned with some of the results obtained. Author (TAB)

N70-14680# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

FREE ENERGY OF FORMATION OF DROPLETS WITH CURVATURE DEPENDENT SURFACE TENSION

Jean-Yves Parlange Sep. 1969 11 p refs
(Contract Nonr-609(47))

(AD-694081; TR-13) Avail: CFSTI CSCL 7/4

It is shown that a recent evaluation of the free energy of formation of droplets when the surface tension depends on the radius of curvature, is incorrect. The exact expression is derived, and it is found that the dependence of free energy of formation on surface tension is essentially cubic. Author (TAB)

N70-14680*# Grumman Aerospace Corp., Bethpage, N.Y.
CHEMICAL REACTION IN LOW AND ZERO GRAVITY A FEASIBILITY STUDY
John Fogarty and Sidney Butner *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 469–491 refs (See N70-14651 04-06)
Avail: CFSTI CSCL 07C

This paper presents the results of a theoretical study to determine the effect of low and zero-gravity on chemical reactions, specifically catalytic polymerization of ethylene using transition metal complexes. Fixed bed, slurry reactor, and fluidized bed polymerization processes are compared under earth gravity and low or zero gravity conditions. Fixed bed polymerization under low or zero gravity does not offer any particular advantages or disadvantages compared to normal gravity processing. Author

N70-14681*# California Univ., Los Angeles.
INDUSTRIAL CHEMISTRY IN SPACE
W. F. Libby and Patrick Payton *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 492–498 (See N70-14651 04-15)
(Grants NGL-05-007-003; AFOSR-1255-68)
Avail: CFSTI

Chemical manufacture relates to a space environment as it relates to air-free chemical preparation. For example, oxygen-free copper would be a premium product. Author

N70-14682*# International Research and Technology Corp., Washington, D.C.
ON THE PRODUCTION AND SEPARATION OF INDUSTRIALLY USEFUL ISOTOPES IN SPACE
Theodore B. Taylor *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 499–538 (See N70-14651 04-15)
Avail: CFSTI CSCL 07D

Preliminary work on a concept of an orbital facility for production and separation of industrially useful isotopes will be discussed. The production facility consists of a large solar powered electrical generator and a high current charged particle accelerator that produces isotopes by bombardment of a suitable target. Several possible methods for chemical or physical separation of the produced isotopes in space will be discussed. Emphasis will be placed on the production of plutonium or uranium-233 for use in terrestrial power reactors. Possible advantages of an orbital facility over a terrestrial one will be discussed. Author

N70-14689# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.
FLOW LIGHT SCATTERING, PART 1: THEORETICAL PRINCIPLES OF THE EFFECT AND APPARATUS FOR ITS MEABUREMENT
W. Heller, R. Tabibian, M. Nakagaki, and L. Papazian 20 Jul. 1969 35 p Submitted for publication
(Contract Nonr-3511(00))
(AD-694522; TR-19(65)) Avail: CFSTI CSCL 7/4

A brief introduction is given into the theory of radiation scattering by rigid spheroids and deformable random coils dispersed or dissolved in a liquid medium subjected to flow at a well defined velocity gradient. The theory is limited, in the former instance, to spheroids whose largest dimension does not exceed (1/3) of the wavelength of the incident radiation. It is shown that the radiation scattering increment produced by flow makes it possible to determine not only the axial ratio, as obtainable by streaming birefringence, but also the numerical values of semimajor and semiminor axis of a spheroid provided two orthogonal components of incident linearly polarized light are used. Essentials of the construction and operation of an apparatus designed for the study of hydrodynamic radiation scattering are described. Author (TAB)

N70-14706# National Research Council of Canada, Ottawa (Ontario). Translation Section.
SOUND ABSORPTION BY OPTICAL PHONONS IN MOLECULAR CRYSTALS [SCHALLABSORPTION DURCH OPTISCHE PHONONEN IN MOLEKUELKRISTALLEN]
H. E. Danielmeyer 1969 18 p refs Transl. into ENGLISH from Acoustica (Stuttgart), no. 17, 1966 p 102–109
(NRC-TT-1381) Avail: CFSTI

Phonon processes of very high order occur in many molecular crystals which determine the sound absorption up to the Mc/s range. The transition probabilities are calculated. The connection between lattice spectrum and relaxation spectrum is discussed and the additional sound absorption is calculated. The results are compared with measurements of the sound absorption in bromine, benzene, cyclohexane, naphthalene, and p-dichlorobenzene. The phonon interaction model also is applicable to liquids. Author

N70-14707# National Research Council of Canada, Ottawa (Ontario). Translations Section.
NEW METHODS OF OBTAINING ORGANOGALLIUM HALIDES. PART 2: HYDROGALLATION REACTIONS [NEUE WEGE ZU ORGANOGALLIUMHALOGENIDEN. 2: HYDROGALLIERUNGSREAKTIONEN]
Hubert Schmidbaur 1969 11 p refs Transl. into ENGLISH from Chem. Ber. (Weinheim), no. 100, 1967 p 1129–1136
(NRC-TT-1389) Avail: CFSTI

Olefins add dichlorogallane and dibromogallane even under mild conditions. These conversions are the first examples of hydrogallation reactions. High yields of organogallium halides of the formula (RGaX2) are obtained. In all cases the addition takes place with anti Markownikoff orientation. The reactions of dichlorogallane with dimethyl butadiene, styrene, acetylene and phenylacetylene are unclear. After hydride-halide exchange, n-propylgallium dichloride is obtained from allyl chloride. Acetone is converted by dichlorogallane into isopropyloxygallium dichloride (1). Corresponding tests with acetonitrile and benzonitrile gave polymeric addition products. Author

N70-14713# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
METHOD OF OBTAINING METAL SULFIDES AND SELENIDES
V. M. Andreev et al 13 May 1969 6 p refs Transl. into ENGLISH from Russian Patent no. 212238, 25 Dec. 1964 1–2 p
(AD-693823; FTD-HT-23-124-69) Avail: CFSTI CSCL 7/1

The patent describes a method for obtaining metal sulfides and selenides by synthesis in the vapor phase of the elements in a vertical reactor. For greater efficiency, the initial charge is placed in the lower section of the reactor which has access to air and is heated above the temperature of the hard-to-volatilize element; at the same time the temperature in the upper section of the reactor is maintained below that of boiling but above that of solidification of the readily volatile component. Author (TAB)

N70-14720# Army Electronics Command, Fort Monmouth, N.J.
HOLOGRAPHY FOR ELECTROCHEMICAL STUDIES: CONCENTRATION GRADIENTS
Dorothy D. Williams Aug. 1969 15 p refs
(Contracts DA-1-T-061102-A-34-A)
(AD-695625; ECOM-3167) Avail: CFSTI CSCL 14/2

The use of holographic interferometry to study concentration changes and diffusion coefficients in a Cu-CuSO4 cell is discussed. The direct relationship of refractive index change to concentration

allows calculation of diffusion coefficients using an optical system which does not disturb the electrochemical processes being studied. Values of diffusion coefficients obtained agree with published literature values. Author (TAB)

N70-14744# Air Force Systems Command, Wright-Patterson AFB, Ohio.

SYNTHESIS OF FERROCENECARBOXYLIC ACIDS AND THEIR DERIVATIVES

I. A. Golubeva 31 Apr. 1969 14 p refs Transl. into ENGLISH from Inst. Neftekhimicheskoi i Gaz. Promyshlennost (USSR) no. 72, 1967 p 61-67

(AD-695395; FTD-HT-23-988-68) Avail: CFSTI CSCL 7/3

Following a tabulation of known methods for synthesis of ferrocenedicarboxylic acids, the paper reports on methods for which increased yields are claimed. Ferrocenecarboxylic acid was prepared (yield 45.2 percent of theory) by hypochlorite oxidation of acetylferrocene, ferrocene-1,1 -dicarboxylic acid (90-92 percent) by similar oxidation of 1,1 diacetylferrocene, carbamylferrocene (70-72 percent) by direct reaction of ferrocene with carbamyl chloride in the presence of AlCl3, and 1,1 -dicarbamylferrocene (almost 100 percent) by passing ammonia through a benzol solution of the diacid chloride. Author (TAB)

N70-14750# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INTERACTION OF BENZOYL- AND, 1, 1, PRIME - DIBENZOYLFERROCENE WITH ACETYLENE IN THE PRESENCE OF SODIUM AMIDE IN LIQUID AMMONIA

T. P. Vishnyakove et al 7 May 1969 8 p refs Transl. into ENGLISH from Tr. Inst. Neftekhim. i Gazovoi Prom. (USSR), no. 72, 1967 p 58-61

(AD-694185; FTD-HT-23-89-69) Avail: CFSTI CSCL 7/3

The compound alpha-oxy-alpha-phenylpropynylferrocene (alpha-ferrocenyl-p-ethynyl benzyl alcohol) was synthesized with a yield of 70 percent by the reaction of benzoylferrocene with acetylene in the presence of sodium amide in liquid ammonia. Two new ferrocene derivatives were synthesized from 1,1-dibenzoylferrocene and acetylene in the presence of sodium amide: 1-benzoyl-1 -(alpha-oxy-alpha-phenylpropynyl) ferrocene (54 percent) and 1,1 -di(alpha-oxy-alpha-phenylpropynyl) ferrocene (55 percent). The physicochemical constants were determined for all of the initially obtained compounds and their IR spectra were taken. Author (TAB)

N70-14795# Maryland Univ., College Park. Dept. of Chemistry.

THE KINETICS OF HYDROGEN BOND FORMATION Final Report, 1 Sep. 1966 - 31 Aug. 1969

Gordon Atkinson Oct. 1969 9 p refs

(Grant DA-ARO(D)-31-124-G818)

(AD-695708; AROD-6494.1-C) Avail: CFSTI CSCL 7/3

This report presents a summarization of the research findings, with the main emphasis being on measuring hydrogen-bond kinetics in a number of different types of systems. The technique used for all of the measurements was ultrasonic absorption. The systems studied were t-butanol in cyclohexane, benzoic and o-toluic acid in 1,2-dichloroethane, ethanol in ethyl chloride, and e-caprolactam in cyclohexane. Author (TAB)

N70-14800# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF OBTAINING SULFIDES OF ORGANOFLUROSILICON COMPOUNDS

B. A. Sokolov et al 22 Apr. 1969 6 p Transl. into ENGLISH from Russian patent no. 190898 (Appl. no. 1037578/23-4, 15 Nov. 1960) 2 p

(AD-694186; FTD-HT-23-1430-68) Avail: CFSTI CSCL 7/3

A method is outlined for obtaining organofluorosilicon compounds. The obtained compounds can be used for the synthesis of new monomers and polymers and also as additives to lubricating oils, antioxidants, and vulcanization accelerators. The method consists of the following: Fluorohydride silanes are subjected to interaction with unsaturated sulfides in the presence of a solution of chloroplatinic acid in isopropyl alcohol with heating up to 40-150C. Author (TAB)

N70-14816# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

A SEMICLASSICAL TREATMENT OF THE OPTICAL MODEL Technical Report

John Ross and R. E. Roberts Aug. 1969 18 p refs Prepared in cooperation with Mass. Inst. of Tech.

(Contract N00014-67-A-0226)

(AD-696076; SQUID-TR-MIT-51-PU) Avail: CFSTI CSCL 7/4

Semicalssical scattering theory is applied to the optical model for two different complex potentials. For the case of a Lennard-Jones interaction, the results for the imaginary part of the phase shift are in excellent agreement with the exact calculation of Marriott and Micha. The use of a modified wave number approximation yields useful estimates. For a complex exponential potential, the semiclassical and quantal expressions for the opacity function at zero impact parameter are identical. Author (TAB)

N70-14826# Army Foreign Science and Technology Center, Washington, D.C.

RADIATION POLYMERIZATION OF OLIGOETHYLENEGLYCOL MALEATE-ADIPATE WITH VARIOUS MONOMERS

S. I. Omelchenko et al 9 Sep. 1969 13 p refs Transl. into ENGLISH from Khimichna Promyslovist (USSR) no. 2, 1968

(AD-694416; FSTC-HT-23-380-69) Avail: CFSTI CSCL 7/5

Radiation copolymerization of oligo(ethyleneglycol-maleate-adipate) with monomers of various structures has been studied. It has been shown that for radiation copolymerization with OMAD, monomers can be arranged in a series according to reaction capability. The cross-linking reaction under the influence of -radiation proceeds more completely than in the presence of peroxide indicators. This is confirmed by data from IR-spectra, results of determination of the gel-fraction content and specific volume of the contraction of the copolymers. Physico-mechanical indices, thermostability and water-resistance in all radiation copolymers studied is higher than in similar copolymers obtained by the thermo-chemical method. Author (TAB)

N70-14834# Army Foreign Science and Technology Center, Washington, D.C.

INVESTIGATION INTO THE PRIMARY PRODUCTS OF IMPULSE PYROLYSIS OF AMMONIUM PERCHLORATE USING A TIME OF FLIGHT MASS SPECTROMETER

V. V. Boldyrev et al 19 Sep. 1969 8 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izvestiya. Seriya Khim., (Russian), no. 6, 1966 p 1372

(AD-695362; FSTC-HT-23-490-69) Avail: CFSTI CSCL 7/2

The thermal breakdown of ammonium perchlorate was studied using a modified experimental method to aid in the detection of instable products. A description of the method used is described. The primary products of the breakdown reaction in the temperature range studied were ammonia and perchloric acid. Author (TAB)

N70-14848*# Becton, Dickenson and Co., Raleigh, N.C. Research Center.

INVESTIGATION OF METHODS FOR THE STERILIZATION OF POTTING COMPOUNDS AND MATED SURFACES Final Report, 13 Aug. 1968 - 12 Oct. 1969

J. J. Tulis 16 Oct. 1969 84 p refs

(Contract NASW-1764)

(NASA-CR-107440) Avail: CFSTI CSCL 07C

The feasibility of sterilizing potting compound at temperatures ranging from ambient to 125 C by addition of sterilant chemicals to the potting compound during the curing process is discussed.

Evidence was obtained which indicated that the polymeric form of monomeric formaldehyde, paraformaldehyde, was considerably more effective as a sterilizing agent than were the formaldehyde resins used. Potting compound sterilant mixtures proved inhibitory against both Gram positive and negative microorganisms, the degree of inhibition being a function of the test organism, sterilant, and sterilant concentration. Evolution of sterilizing gas subjected embedded bacterial spores to in situ inactivation with the resultant sterilization of the entire component. Procedures were developed that should ensure the internal sterility of electronic spacecraft components. Author

N70-14883# Illinois Univ., Chicago. Dept. of Chemistry.
NATURE OF THE TRANSITION STATE IN THE OXIDATION OF ALCOHOLS Final Report 1 Jun. 1965 - 15 Dec. 1968
Jan Rocek Sep. 1969 8 p refs
(Grants DA-ARO(D)-31-124-G690; DA-ARO(D)-31-124-G871; DA-ARO(D)-31-124-G946)
Avail: CFSTI CSCL 7/3

An investigation of a few typical oxidation reactions is briefly summarized. The objective of the research was to enhance the understanding of the rate limiting step. The original plan was to investigate the chromium VI oxidation of alcohols, but the study was extended to olefinic compounds, and contributed to the understanding of the oxidation of the double bond as well as to the nature of hydrogen transfer reactions. Author (TAB)

N70-14929# Stanford Research Inst., Menlo Park, Calif.
RESEARCH ON METASTABLE SPECIES IN ATOMIC AND MOLECULAR BEAMS PRODUCED BY CHARGE TRANSFER, TASKS 1, 2, AND 3 Final Report
J. R. Peterson and G. Black 15 May 1969 20 p refs
(Contract DA-31-124-ARO(D)-446; ARPA Order 553)
(AD-695684) Avail: CFSTI CSCL 4/1

The report covers three tasks. In Task I, beam methods have been developed to study details of energy transfer processes of metastable excited atoms and molecules in collisions with ground state species. In task II, flowing afterglow techniques and pulsed photolysis methods involving optical detection of photolysis fragments have been used to study exothermic energy transfer reactions in excited atmospheric gases. Task III was a shorter, more specific task concerned with optical measurements of the radiation from clouds of barium after their release, or generation, at high altitudes. Author (TAB)

N70-14953# Warner and Swasey Co., Flushing, N.Y. Control Instrument Div.
STRENGTHS OF THIRTY-ONE WATER VAPOR LINES BETWEEN 1617 AND 1429/cm Final Report, 1 Jul. 1967 - 30 Jun. 1969
Burton Krakow and Anthony R. Healy 11 Jul. 1969 34 p refs
(Contract F19628-67-0382)
(AD-695045; W/S-TR-47; AFCRL-69-0343) Avail: CFSTI CSCL 7/4

Measurement was made of the strength of 31 strong lines in the v2 band of H2O using a modified curve of growth technique. Comparison of the measured line strengths with theoretical line strengths calculated by Benedict and Calfee indicate that the band strength used in the calculation should be lowered from 317 /(sq.cm. atm.) to 300(sq.cm. atm). When the band strength of 300(sq cm atm) is used, the calculated and measured line strengths agree to within the experimental accuracy for 30 of the 31 lines studied. TAB

N70-14958# Aerospace Corp., El Segundo, Calif. Lab. Operations.
LINE WIDTHS IN THE PURE ROTATIONAL SPECTRUM IN CARBON MONOXIDE Technical Report, Feb. 1968 - Apr. 1969
Jerome M. Dowling 29 Aug. 1969 38 p refs
(Contract F04701-69-C-0066)
(AD-695457; TR-0066(9260-01)-4; SAMSO-TR-69-305) Avail: CFSTI CSCL 7/4

Self-broadened semi-halfwidths of the pure rotational lines J = 7+6 through J = 20+19 have been measured for carbon monoxide, assuming a dipole moment of 0.112 Debye. These widths are narrower than those determined from vibration-rotation bands. The semi-halfwidth decreases anomalously from the J = 9+8 to the J = 10+9 transition. The measurements were derived from two-beam interferometric data, and the corrections required because of finite resolution and other instrumental effects are discussed. TAB

N70-14960# Massachusetts Inst. of Tech., Cambridge Dept. of Chemistry.
RELAXATION IN A DILUTE BINARY GAS MIXTURE
John Ross and Raymond Kapral Lafayette, Ind. Purdue Univ. Sep. 1969 22 p refs
(Contract N00014-67-A-0226; Proj. Squid)
(AD-696077; MIT-52-Pu) Avail: CFSTI CSCL 7/4

The relaxation of a dilute hard sphere binary gas mixture is studied in the limit of vanishingly small concentration of one of the species. The velocity autocorrelation function and diffusion coefficient are evaluated by the integral approximation and Chapman-Enskog methods. Solutions are obtained as a function of the ratio of the masses of the two species and the limiting cases of the Rayleigh and Lorentz gases are considered in some detail. While the convergence of the Chapman-Enskog method becomes poor as the Lorentz limit is approached, the integral approximation yields solutions which are exact in this limit. In the Rayleigh limit, both methods yield the exact result. Author (TAB)

N70-14961*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO-STEP MECHANISM FOR ORDER-DISORDER KINETICS IN SILICATES
Robert F. Mueller Nov. 1969 20 p refs
(NASA-TM-X-63775; X-644-69-502) Avail: CFSTI CSCL 07D

The apparent high activation energy barrier associated with the lower temperature limit of cation ordering in certain silicates is attributable to a mechanism involving two consecutive steps in the ordering process. This mechanism is regarded as responsible for certain ordering characteristics which distinguish metamorphic, igneous plutonic and volcanic pyroxenes. An important consequence is that order-disorder equilibrium can be attained at temperatures below the lower temperature limit only through recrystallization and not by thermal annealing which does not result in recrystallization. Author

N70-14967# Army Foreign Science and Technology Center, Washington, D.C.
THERMAL DECOMPOSITION OF AMMONIUM PERCHLORATE DURING X-RAY IRRADIATION
A. I. Skorik et al. 2 Oct. 1969 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Teknol. (Moscow), v. 11, no. 7, 1968 p 744 - 747
(AD-695732; FSTC-HT-23-527-69) Avail: CFSTI CSCL 7/5

It is established that irradiation at the monent of decomposition accelerates the decomposition of ammonium perchlorate containing additives of NiO, Ni2O3, and Co3O4, and has no effect on the kinetics of the decomposition of pure ammonium perchlorate and of ammonium perchlorate containing additives of CdO, CdS, Fe2O3, CuI, PbO, WO3, and MoO2. It was also shown that the existing theories on the mechanism of the effect of preliminary irradiation on the subsequent thermal decomposition of ammonium perchlorate do not explain the observed effect. Author (TAB)

N70-14975# Ohio State Univ. Research Foundation, Columbus. Dept. of Chemistry.
TRANSANNULAR INTERACTIONS OF HETERO ATOMS IN MEDIUM-SIZED HETEROCYCLIC COMPOUNDS Final Report, 1 Jun. 1968 - 30 May 1969

Leo A. Paquette 15 Sep. 1969 12 p refs
(Grant DA-ARO(D)-31-124-G831)
(AD-695705; AROD-6294-9-C; FR-5) Avail: CFSTI CSCL 7/3

An examination was made of the role which heterocyclic atoms, strategically located in medium-sized rings, play in reactions which are known from related carbocyclic systems to proceed with a high degree of carbonium ion character. Research centered on the following topics: Acid-promoted rearrangements involving transannular ether oxygen participation; brosylate acetolysis; and photoisomerization of selected 3-cycloheptenone derivatives.
Author (TAB)

N70-14987# Naval Ship Research and Development Center, Annapolis, Md.
APPLICATION OF A THEORY OF BINARY SOLUTION SURFACE TENSION TO ABSORPTION PHENOMENA
Donald J. Cotton Oct. 1969 22 p refs
(AD-694931; MATLAB-381; NSRDC-3065) Avail: CFSTI CSCL 7/4

A theory of surface tension of binary solutions is extended to apply to adsorption from solutions. Experimental work on the adsorption of several fatty acids from aqueous solutions by Nichrome V powder is presented and the theory is used in the analysis. The theory is also tested with literature data on adsorption from aqueous solutions of aliphatic and aromatic compounds by carbon blacks and graphites. A method for the determination of specific surface areas of adsorbents from solution is presented and applied.
Author (TAB)

N70-15004# Arizona State Univ., Temple. Dept. of Physics.
ENTROPY AND INDISTINGUISHABILITY Technical Progress Report 1 Jul. – 31 Oct. 1969
David Hestenes Aug. 1969 14 p refs
(Contract N00014-68-A-0306-002)
(AD-694541; TR-2) Avail: CFSTI CSCL 20/13

It is argued that the principle of indistinguishability of identical particles is a necessary condition for consistency between experimental and statistical descriptions of a many-particle system. Therefore, it is not a special feature of quantum theory, and its use is perfectly justified in classical statistical mechanics.
Author (TAB)

N70-15065# Iowa Univ., Iowa City. Dept. of Chemistry.
THE ELECTROLYTIC OXIDATION OF ORGANIC ANIONS IN NON-AQUEOUS SOLVENTS Final Report
Stanley Wawzonek 30 Sep. 1969 7 p refs
(Contract DA-31-124-ARO(D)-406; DA-ARO(D)-31-124-G393)
(AD-695714; AROD-3726-2-C) Avail: CFSTI CSCL 7/3

Research dealing with the oxidation of aromatic amines, the anions of aliphatic nitro compounds, and o-phthalic acid is described.
Author (TAB)

N70-15088# California Univ., Riverside. Dept. of Chemistry.
PHOTOPHYSICAL PROCESS IN MOLECULAR SOLIDS Final Report, 16 Mar. 1966 – 12 May 1968
David R. Kearns 1 Sep. 1969 48 p refs
(Contract DA-ARO(D)-31-124-G804)
(AD-695706; AROD-6223-13-P) Avail: CFSTI CSCL 7/4

It is generally presumed that the photochemistry of aromatic ketones proceeds from the lowest triplet state of the molecule, but if the second triplet state lies near the lowest triplet state, then it could play a role in room temperature photochemistry. Because of the intrinsic weakness of the S to T(pi,pi) compared to the S to T(n,pi) transition, and the small splitting between the singlet (n,pi) and triplet (n,pi) states it is not surprising that the singlet (pi,pi) state has not been located in an aromatic ketone where the triplet (n,pi) state is the lowest excited state. In the present work an attempt was made to overcome this difficulty by making use of the fact that S to T(pi,pi) transitions are selectively enhanced both by internal and external heavy-atom perturbations, and by carrying out the measurements both at 77K and 4K on single crystals.
Author (TAB)

N70-15099 Case Western Reserve Univ., Cleveland, Ohio.
STRESS AND HYDROGEN PERMEATION IN AUSTENITIC STAINLESS STEEL
Konrad Johann Arnold Kundig (Ph.D. Thesis) 1968 64 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-9417

The permeation of hydrogen through a stable austenitic stainless steel was confirmed. The diffusivity of hydrogen in this alloy was estimated by use of the diffusion lag time technique in specimens charged by electrolysis from an HCl solution. An applied tensile stress increased the permeation of hydrogen, most probably by an increase in solubility for the interstitial. The partial molar volume of hydrogen in the steel was measured, and its value suggests tetrahedral occupation by the dissolved hydrogen. Severe plastic deformation caused trapping at ambient temperatures.
Dissert. Abstr.

N70-15117 California Univ., Berkeley.
STRAIN-ENERGY INTERACTIONS BETWEEN SOLUTE ATOMS AND DISLOCATIONS
Tibor Stefansky (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-10,388

The stress required to drive a single dislocation through a fixed array of isotropic stress centers, due to substitutional solute atoms, is calculated using linear elasticity and numerical methods. Cottrell's model of the strain-energy interaction between solute atoms and dislocations is extended by allowing the dislocation to relax to its equilibrium shape in the stress fields of such atoms. Two new results are obtained. First, a marked concentration dependence of the flow stress is observed only in the very dilute range. And second, the force-displacement diagrams for cutting the stress fields of attractive and repulsive impurity atoms in solution are not identical.
Dissert. Abstr.

N70-15118 California Univ., Berkeley.
MOLECULAR ORBITAL STUDIES IN ORGANIC CHEMISTRY
James Sherman Wright (Ph.D. Thesis) 1968 263 p
Avail: Univ. Microfilms: HC $11.95/Microfilm $3.40 Order No. 69-10410

The most widely used molecular orbital theories are developed, starting from Hartree-Fock SCF theory, and the relationship between theories is shown. Application is made to a study of charge distributions in hydrocarbon ions, using the standard methods. The addition of a dielectric constant to the repulsion integrals is tested, and found to have some merit. Hydrocarbon acidities are correlated by SCF pi-electron theory, which is shown to be an improvement over HMO theory. The SCF equations are extended to allow for the field effect of an external charge or dipole, and the resulting equations are applied to a study of aryl hydrogen exchange rates, and to reactivities and equilibria in the benzene and naphthalene systems.
Dissert. Abstr.

N70-15133# National Research Council of Canada, Ottawa (Ontario). Translations Section.
REVERSIBLE ATTACK OF STANNYL RADICALS ON ALPHA-OLEFINES [REVERSIBLER ANGRIFF VON STANNYLRADIKALEN AUF ALPHA-OLEFINE]
W. P. Neuman et al 1969 5 p refs Transl. into ENGLISH from Tetrahedron Letters (London), no. 22, 1967 p 2041–2043
(NRC-TT-1384) Avail: CFSTI

The radical hydrostannation of alpha-olefines is a radical chain reaction involving the following two steps (1) RCHCH2 + R3Sn yields RCHCH2SnR3 and (2) RCHCH2SnR3 + R3SnH yields RCH2CH2SnR3 + R32Sn. By using a cis-piperylene as the

olefine and making two moles of this olefine act on one mole of organostannane, one mole of the olefine is recovered with other products. Partial isomerization of this olefine by rotation about the simple carbon-carbon bond proves the reversibility of step (1). In the experiment when pure cis-piperylene and trimethyl hydride were used 31% of the excess mole of olefine was recovered as trans-isomer and 7% of the cis-isomer in the excess mole of olefine when pure trans-piperylene was used. Author

N70-15154# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Neutronenphysik.
THE DIFFUSION OF HYDROGEN AND DEUTERIUM IN NIOBIUM AND VANADIUM [DIE DIFUSION VON WASSERSTOFF UND DEUTERIUM IN NIOB UND VANADIUM]
Gunter Schaumann Jul. 1969 90 p refs in GERMAN
(JUL-606-FN) Avail: CFSTI

Diffusion constants for hydrogen and deuterium in the space centered cubic transition metals vanadium and niobium were determined by calculating the double force tensor of the relaxation process caused by secondary elastic diffusion effects of the rapidly moving point defects. Each point defect caused hydrogen atom transfer from the restricted into the expanded regions of the niobium and vanadium lattices. Their motion velocity was determined by diffusion constant and diffusion after-effects. A quantum mechanical band model was formed that explains observed high diffusion velocities - even at low temperatures - by energy differences between ground state and the first excited state of the hydrogen atom. Measured diffusion data for H in Nb at temperatures above 300 K and at activation energies of 0.11 eV agreed with results obtained by neutron scattering analyses on niobium lattices. Transl. by G.G.

N70-15157# National Research Council of Canada, Ottawa (Ontario). Translation Section.
THE PREPARATION AND PROPERTIES OF ALKYL-HYDRO POLYSULPHIDES
E. Boehme et al 1969 11 p REFS Transl. into ENGLISH from Ann. Chem. (Weinheim), no. 585, 1954 p 142–149
(NRC-TT-1382) Avail: CFSTI

By conversion of the acyl-sulfur chlorides with mercaptans, alkyl- or aryl-acyl disulfides were obtained. The rate of alcoholysis catalyzed by hydrogen chloride and nitrogen and by titration of the reduction equivalent was determined using alkyl-acetyl disulfides. Ethyl-hydro disulfide, synthesized from ethyl-acetyl disulfide, was distilled at atmospheric pressure without decomposing. Benzyl-acetyl and benzyl-hydro trisulfides were distilled; alkyl- and methyl-hydro trisulfides were prepared by solvolysis; and ethyl-hydro trisulfide was obtained by alcoholysis. Experimental procedures are described. J.A.M.

N70-15163# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
FUNDAMENTAL ELECTROCHEMICAL STUDIES OF ADSORPTION, KINETICS, AND EXCITED ELECTRONIC STATES Final Report, 1 Jan. 1964 - 30 Jun. 1968
Royce W. Murray and Charles N. Reilley Sep. 1969 21 p refs
(Grants AF-AFOSR-584-64; AF-AFOSR-584-66)
(AD-694575; AFOSR-69-2482-TR) Avail: CFSTI CSCL 7/4

Application of modern transient techniques to the study of metal complex adsorptions at mercury electrodes has strengthened further the suspected dominating influence of the ligand adsorption properties in the adsorption process. Adsorptions of cadmium iodide, indium(III)thiocyanate, and the organometal phenyl-mercury(II) have been studied. Inhibition of electrode processes by adsorbed species has also been examined for the unusual cases of lead halides (two-dimensional crystallizations) and brucine (simulated optically active electrodes). Extensive development of the field of thin-layer electrochemistry has been made. Design, theoretical characterization, and application of twin working electrode cells have been accomplished, with emphasis on general steady-state current features and application to chemical kinetics (benzidine rearrangement, uranium(V) disproportionation). Single electrode cells have been used in potential scan coulometry and have been modified to alleviate edge diffusion effects (getter electrode). The development of thin-layer cells useful for in situ spectral measurements was also accomplished and a number of applications made (metal acetylacetonate reactions, infrared study of ninhydrin reduction, o-tolidine oxidation, fluorescence). Work in A.C. polarographic instrumentation has produced a high-performance instrument having good signal-to-noise and lacking troublesome tuned amplifier components. A study of acetylacetonate coordination chemistry has revealed a 1:2 complexation with lithium ion in acetonitrile solvent. Author (TAB)

N70-15196 Texas A&M Univ. College Station.
A STUDY OF THE ELECTRONIC TRANSITIONS OF SULFUR DIOXIDE
Ivan Warren Watkins (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-5163

In order to correlate the electronic transitions of sulfur dioxide with published Walsh-type diagrams, the pertinent data available to the literature was accumulated, critically evaluated, and checked experimentally where necessary. A perturbed symmetric rotor program was developed to calculate intensity contours of absorption bands to aid in the determination of geometrical structures of excited states and polarizations of electronic transitions. It was found that the published Walsh-type diagrams must be incomplete. A correlation diagram was then proposed to explain the SO2 data. Dissert. Abstr.

N70-15200 Pennsylvania Univ., Philadelphia.
THE OXIDATION OF TITANIUM THIN FILMS
Michael Jordan Mindel (Ph.D. Thesis) 1968 215 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 69-5649

The purpose of this experiment was to elucidate the nature of the oxidation of clean titanium surfaces. The clean surfaces were obtained using thin film techniques under ultra high vacuum conditions. The concatenation of electron microscopy, X-ray line broadening analysis, and gravimetric measurements show that: (1) The nucleation of the oxide depends strongly upon the physical nature of the surface with large needles or platelets nucleazing first on rough surfaces followed by a planar oxide covering the surface; only the planar oxide formed on smooth surfaces. (2) The initial sticking coefficient of oxygen on titanium can be described in both cases by a model involving surface diffusion of oxygen to these growing oxide nuclei. (3) After the oxide covers the entire surface the subsequent gain in thickness takes place via cationic interstitial transport through the oxide. (4) Vacancies generated in the metal by the reaction at the metal-oxide interface remain in solution and oppose further oxidation of the metal. Dissert. Abstr.

N70-15226# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
MODERN TRENDS IN ACTIVATION ANALYSIS, VOLUME 1
James R. De Voe and Philip D. La Fleur, eds. Jun. 1969 688 p refs Held at Gaithersburg, Md., 7-11 Oct. 1968 Sponsored jointly with AEC, IAEC, and EURISTOP
(NBS-Spec-Publ-312-Vol-1) Avail: SOD $8.50

Various applications of activation analysis and radiochemical separation methods are illustrated. Emphasis is placed on studies in environmental sciences, biology, medicine, archeology, criminology, geochemistry, geology, and industry. For individual titles see N70-15226 through N70-15312.

N70-15227# Western Regional Hospital Board, Glasgow (Scotland).
ACTIVATION ANALYSIS IN THE CONTEMPORARY

WORLD: QUESTIONS AND ANSWERS

J. M. A. Lenihan *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 1–32 refs (See N70-15226 04-06)

Avail: SOD $8.50

Activation analysis is defined as the revelation of chemical composition through modification of nuclear behavior; its characteristics, potentials and limitations are reviewed for nucleus bombardment with neutrons, photons, or other charged particles such as protons, deuterions and ions of hydrogen or helium. Described are the following processes: (1) transfer of energy; (2) incorporation of projectile particle into the target; (3) adjustment of the compound nucleus; and (4) decay of the radioactive product. General considerations regarding the scope and exploitation of activation analysis in cosmic geological, biological, artificial, and social environments are briefly outlined. G.G.

N70-15228# Michigan Univ., Ann Arbor. Dept. of Meteorology and Oceanography.

THE HALOGEN COMPOSITION OF AEROSOL PARTICLES OVER LAKE MICHIGAN

Ronald H. Lucks, John W. Winchester, Wayne R. Matson, and Mary A. Tiffany *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 36–42 refs (See N70-15226 04-06)

(Contract AT(11-1)-1705; Grants AP-00585; NSF GA-811)

Avail: SOD $8.50

Chemical analysis for halogens was carried out by neutron activation of sampled aerosols impacted on the surface of a polyethylene insert inside sampler. Washing and separation of iodine, bromide, and chlorine by solvent extraction was followed by beta counting. Analysis for lead, cadmium, and copper was performed by anodic stripping voltammetry. A summary of the halogen results established the following: (1) iodine concentrations did not vary with proximity to urban-industrial areas and constituted no significant air pollution sources; (2) bromine values were much greater in samples collected over industrial sections; and (3) chlorine sample data showed definitely higher concentrations over urban industrial areas, probably attributable to industrial sources. G.G.

N70-15229# Argonne National Lab., Ill.

THERMAL NEUTRON ACTIVATION ANALYSIS OF AIRBORNE PARTICULATE MATTER IN CHICAGO METROPOLITAN AREA

S. S. Brar, D. M. Nelson, E. L. Kanabrocki, C. E. Moore, C. D. Burnham et al *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 43–54 refs Prepared jointly with Loyola Univ., Chicago (See N70-15226 04-06)

Avail: SOD $8.50

Thermal neutron analysis in conjunction with NaI(Tl) crystal gamma-ray spectrometry was used to detect 13 trace elements present in air particulate samples from twenty-two different locations throughout the Chicago area. Nanograms per standard cubic meter of surface air were obtained for chlorine, bromine, and iodine. Data presented showed evidence of the chemical reactivity that affected the variations in the chemical composition of stable aerosols. High chlorine concentrations found could have resulted either from pollution sources or natural chlorine aerosol levels. G.G.

N70-15230# Argonne National Lab., Ill.

APPLICATION OF ACTIVATION ANALYSIS AND Ge(Li) DETECTION TECHNIQUES FOR THE DETERMINATION OF STABLE ELEMENTS IN MARINE AEROSOLS

N. D. Dudley, L. E. Ross, and V. E. Noshkin *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 55–61 refs Sponsored in part by AEC (See N70-15226 04-06)

Avail: SOD $8.50

The feasibility of elemental analysis on airborne particles by neutron activation and germanium-lithium detectors was confirmed by determining the concentration of twenty trace elements in ocean aerosol samples. Each nuclide was identified by: (1) the energy of its gamma ray; (2) the half life; (3) the presence of associated gamma rays with proper relative intensities; and (4) the presence of nuclides on the appropriate ion exchange resin used in the separation filter method. Results for 5 samples taken over the Atlantic Ocean indicated aeolian transport as the important mechanism for input of trace elements into the ocean. G.G.

N70-15231# Institute for Soil Fertility, Haren-Groningen (Netherlands).

ACTIVATION ANALYSIS APPLIED TO SEDIMENTS FROM VARIOUS RIVER DELTAS

A. J. de Groot, K. H. Zschuppe, M. de Bruin, J. P. W. Houtman, and P. Amin Singgih *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 62–71 refs Prepared jointly with Reactor Instituut and Atomic Reactor Centre (See N70-15226 04-06)

Avail: SOD $8.50

Nondestructive activation analysis was used to determine the transport of mud and its chemical behavior for a number of deltas through change of concentration in trace elements of the finest grain size fractions. Samples were irradiated for different periods of time and their gamma spectra were obtained after cooling, again for differing time periods. Comparison of chemical and activation analytical results found good agreement for manganese and also for the single value of zinc; the sequence of mobilization of organomatallic complexes of trace elements remained the same for all river deltas in Western Europe. A much smaller mobility of trace elements in tropical deltas was observed when compared to the mobility in deltas under temperate climatic conditions. G.G.

N70-15232# Palermo Univ. (Italy).

MEASUREMENTS OF MOVEMENTS OF SOLID SUBSTANCES IN WATER BY MEANS OF STABLE TRACERS AND ACTIVATION ANALYSIS

Carmelo Cappadona *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 72–75 refs (See N70-15226 04-06)

Avail: SOD $8.50

The movement of sand at an Italian beach was studied by fixing grain samples with a predetermined percentage of silver as tracer material and by scattering samples along the coast line in the sea. Samples retrieved after some time were then treated for extraction of Ag and subsequent irradiation of Ag to determine trace elements. Measurements of neutron activity were carried out by discrimination between the photoelectric peaks of Ag-108 from Ag-111. G.G.

N70-15233# Missouri Univ., Columbia.

SPECIFIC ACTIVATION ANALYSIS TECHNIQUES AND METHODS FOR THE ASSAY OF TRACE SUBSTANCES IN AQUATIC AND TERRESTRIAL ENVIRONMENTS

G. W. Leddicotte *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 76–80 (See N70-15226 04-06)

Avail: SOD $8.50

Samples of water, soil, stream sediments, dust, vegetation and similar materials from aquatic and terrestrial environments have been assayed for their element contents in order to identify potential hazards resulting from the use of pesticides, fungicides, or industrial pollutants. Radioactive products of thermal neutrons were used as indicators and gamma-ray spectroscopy was applied to complete the assay of the induced radionuclide species. Results of data obtained in activation analyses of various materials investigated are represented in table form and cover trace element distribution as well as chloride pesticide residues. G.G.

N70-15234# Stanford Univ., Calif. Dept. of Civil Engineering.
POST-SAMPLING ACTIVATION ANALYSIS OF STABLE NUCLIDES FOR ESTUARY WATER TRACING
J. K. Channell and P. Kruger *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 81–86 refs (See N70-15266 04-06)
Avail: SOD $8.50

The feasibility of using stable, high neutron capture cross section, rare earth elements (REE) as external tracers in estuarine waters is being investigated. The method utilizes the inherent sensitivity of radioactivation analysis and avoids introducing radioactive materials into the estuary. The development of the method includes considerations of: (1) the most suitable tracer element; (2) an optimum radiochemical-activation-counting procedure for estuarine waters; (3) the natural background concentrations of the element and its variability in the estuary system; (4) the persistence of the element in estuarine waters containing suspended solids and bottom muds; and (5) a comparison of tracer plus analytical costs between this method and fluorescent dyes. This method adapts the procedures reported for open-ocean analysis to separate the REE as a group from estuarine water samples. Author

N70-15235# Colorado Univ., Boulder. Dept. of Civil Engineering.
NEUTRON ACTIVATION ANALYSIS OF VANADIUM IN NATURAL WATERS
K. D. Linstedt and Paul Kruger *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 87–92 Prepared in cooperation with Stanford Univ. (See N70-15226 04-06)
Avail: SOD $8.50

Occurrence and behavior of vanadium in natural waters was investigated by radiochemical separation and gamma-ray spectroscopic analysis on samples that included preirradiation vanadium concentrations to increase the natural vanadium content in the irradiation volume to a level above the sensitivity limit of the activation method; postirradiation separation reduced the interference of other radionuclide activities. A flow diagram of the complete activation analysis procedure is included. Concentration data from various natural water sites showed a vanadium range from 0.2 microgram to 49.2 microgram per liter. G.G.

N70-15236# Gulf General Atomic, San Diego, Calif.
NEUTRON ACTIVATION ANALYSIS INDENTIFICATION OF THE SOURCE OF OIL POLLUTION OF WATERWAYS
V. P. Guinn and S. C. Bellanca *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 93–97 refs (See N70-15226 04-06)
(Contract AT(04-3)-167)
Avail: SOD $8.50

This paper is concerned with a method of determining the origin of a given pollution event in which fresh water, brackish water or sea water is polluted–accidentally or intentionally–by heavy oil (crude oil or heavy fuel oil). The method employed in this exploratory study was that of trace-element characterization via purely instrumental neutron activation analysis (NAA). In these exploratory measurements, 16 different marine fuel oils were analyzed by NAA, and their V, Mn, Na, Co, Sb, As, Cu, and Zn levels compared. The effects of prolonged contact with sea water and with fresh water upon these trace-element concentrations was also explored. The results indicated clearly the possibility of NAA trace-element characterization of oil-slick samples. Author

N70-15237# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.
THE MULTIELEMENT ANALYSIS OF BIOLOGICAL MATERIAL BY NEUTRON ACTIVATION AND DIRECT INSTRUMENTAL TECHNIQUES
Louis A. Rancitelli, John A. Cooper, and Richard W. Perkins *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 101–109 refs (See N70-15226 04-06)
(Contract AT(45-1)-1830)
Avail: SOD $8.50

Direct instrumental neutron activation analysis of biological material employing both Ge(Li) and NaI(Tl) gamma-gamma multidimensional coincidence spectrometry was used to determine some 20 trace element concentrations simultaneously in tissues. Example measurements on ratios of rubidium and cesium to potassium in muscle tissues of salmon were compared with corresponding ratios in sea water. It was concluded that rubidium and potassium were taken up by this organism in direct proportion to their concentration in sea water; the organism had the ability to differentiate and accumulate cesium relative to potassium. G.G.

N70-15238# Massachusetts General Hospital, Boston.
MULTIELEMENT ANALYSIS OF PATHOLOGICAL TISSUE
D. M. Linekin, J. F. Balcius, R. D. Cooper, and G. L. Brownell *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 110–113 refs Prepared jointly with Army Natick Labs. (See N70-15226 04-06)
Avail: SOD $8.50

A nuclear activation technique is described which permits simultaneous measurements of several trace elements in pathological tissues. The method combines activation with thermal neutrons, detection by coaxial Ge(Li) detector, and data analysis by computer; results are expressed in terms microgram of trace elements per gram of wet tissue or per milliliter blood. Analysis of trace elements in a diseased lung resembling asbestosis or silicosis found greater bromine and zinc concentrations in the fibrotic parenchyma than in normal linings. Trace element measurements in the blood, heart, and diaphragm of a hamster with dystrophy-like myopathy showed increased zinc and cobalt concentrations in the dystrophic heart and a decrease in zinc concentration in the dystrophic blood. Activation analytical results on rhabdomyosarcoma mice tumors established greater than normal chromium and iron concentrations. G.G.

N70-15239# Atomic Energy Commission, Paris (France). Frederic Joliot Hospital.
THE USE OF NEUTRON CAPTURE GAMMA RADIATIONS FOR THE ANALYSIS OF BIOLOGICAL SAMPLES
D. Comar, C. Crouzel, M. Chasteland, R. Riviere, and C. Kellershohn *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 114–127 refs (See N70-15226 04-06)
Avail: SOD $8.50

Capture gamma ray detection during neutron irradiation of dried and ashed biological samples is described and compared with results obtained by in vivo irradiations of the human tibia. Comparison of spectra from irradiated samples with those from standards containing known quantities of the different elements investigated showed that the 2.23 MeV hydrogen peak predominated; elements identified in the samples were those with the highest mass cross-capture spectrum to atomic weight ratio. Localized neutron irradiation of the tibia made it possible to calculate calcium and chlorine mass ratio by recording emission capture gamma ray peaks directly proportional to the mass of the elements irradiated. G.G.

N70-15240# Rochester Univ., N.Y.
ELEMENT IMBALANCES OF ATHEROSCLEROTIC AORTAS
W. H. Strain, C. G. Rob, W. J. Pories, R. C. Childers, M. F. Thompson, Jr. et al *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 128–133 refs Sponsored jointly with NIH and US Air Force Prepared jointly with AFSC, Wright-Patterson (See N70-15226 04-06)
(Grant PHS-HE-10213)
Avail: SOD $8.50

Activation analysis has been used to determine element imbalances that may contribute to the development of

atherosclerosis. The analyses were conducted on normal and atherosclerotic aortas from rats and man as well as on a human abdominal aortic aneurysm. The procedure was restricted to the determination of Ca, Cd, Co, Cu, Mg, Mn, Se, V, and Zn, since these elements seem to be most important to arterial metabolism. It has been established that aortic calcium is greatly elevated in atherosclerosis, but there is little data on the changes in content of the other elements in arterial tissue. The investigation was carried out to provide additional information on vascular trauma and degeneration. It is an extension of our work on oral zinc therapy for the treatment of atherosclerosis. Author

N70-15241# Missouri Univ., Columbia. Research Reactor Facility.

A USEFUL NEUTRON ACTIVATION ANALYSIS METHOD FOR THE DETERMINATION OF TELLURIUM IN HUMAN TISSUES

A. Abu-Samra and G. W. Leddicotte *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 134–137 refs (See N70-15226 04-06)

Avail: SOD $8.50

A single element technique with chemical separation was used to determine tellurium traces in human tissue in concentrations of parts per million or less. Destructive distillation of irradiated samples was used to free the iodine-131 isotope and the iodine carrier in the Te-130,-131 to iodine-131 reaction from the interferences of other radioactive species produced in the sample during irradiation. The I-131 and its carrier were then removed from the distillate by solvent extraction with chloroform and precipitated as AgI to determine the chemical yield. Resulting and corrected data show the probable concentration of tellurium in human hard and soft tissues. G.G.

N70-15242# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.

NEUTRON ACTIVATION ANALYSIS OF BRAIN FOR COPPER AND MANGANESE

J. F. Emery, S. B. Lupica, W. S. Lyon, and Edward D. Bird *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 138–141 ref Sponsored in part by AEC Prepared in cooperation with Wake Forest Coll. (See N70-15226 04-06)

(Grant NIH G-AM-12746-01)

Avail: SOD $8.50

Effects of the tranquilizing drug phenothiazine on copper and manganese concentrations in the basal ganglia of primates were studied by neutron activation analysis. Radiochemical separation with antimony pentoxide was used to remove sodium from activated samples. Resulting sodium chloride-free gamma-ray spectra, obtained by NaI(Tl) detector, exhibited pronounced Cu-64 and Mn-56 photopeaks. After corrections for decay, the photopeak areas of the samples were compared with those of the standards and the amounts of Cu and Mn present determined by calculation. G.G.

N70-15243# Naval Research Lab., Washington, D.C.

NEUTRON ACTIVATION ANALYSIS OF BARNACLE SHELLS

C. M. Gordon and R. E. Larson *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 142–146 refs (See N70-15226 04-06)

Avail: SOD $8.50

The work presented here concerns the effect of salinity on the deposition of calcium, manganese, magnesium, strontium and sodium in barnacle shells. The technique employed in this investigation is radioactivation with reactor neutrons and computer analysis of the resultant gamma-ray spectra. The gamma-ray spectrometer consists of a Ge(Li) detector in combination with a channel pulse-height analyzer. Two computer programs have been written to process data from this instrument. Initial results indicate that manganese most strongly correlates with salinity. Manganese content in the barnacle shells generally varied inversely to the salinity of the aquatic habitat. No measurable correlation between strontium concentration and salinity was found. G.G.

N70-15244# Texas A&M Univ., College Station. Activation Analysis Research Lab.

SAMPLING METHODOLOGY DEVELOPMENT IN A LARGE SCALE CYSTIC FIBROSIS SCREENING PROGRAM BASED ON AUTOMATED NEUTRON ACTIVATION ANALYSIS

L. E. Fite, R. E. Wainerdi, H. P. Yule, G. M. Harrison, G. Bickers et al *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 147–155 refs Sponsored by AEC Prepared jointly with Tex. Inst. for Rehabil. and Res. (See N70-15226 04-06)

Avail: SOD $8.50

Nail clippings from newborn infants were studied by activation analysis in an effort to detect cystic fibrosis through the presence of unusually high sodium concentrations. Following activation by thermal neutron flux, clippings were analyzed by gamma-ray spectrometers with NaI(Tl) detectors. Counting periods were recorded and analized by computers for Na-24 yields of 1.37 MeV and 2.76 MeV full energy peaks. Results were compared with standards containing known quantities of sodium. G.G.

N70-15245# Washington Univ., Seattle. Dept. of Nuclear Engineering.

CLINICAL EXPERIENCE WITH THE USE OF NEUTRON ACTIVATION ANALYSIS IN THE DIAGNOSIS OF CYSTIC FIBROSIS

Gene L. Woodruff, William E. Wilson, Jr., Yuki Yamammoto, Albert L. Barb, and Stanley J. Stamm (Children's Orthopedic Hosp. and Med. Center, Seattle, Wash.) *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 156–159 refs Sponsored in part by Natl. Cystic Fibrosis Res. Found. (See N70-15226 04-06)

Avail: SOD $8.50

Engineering problems in the clinical screening technique for cystic fibrosis, based on measurements of trace element concentrations in tissue samples, are outlined. Nail samples are irradiated and subsequently counted separately for beta and gamma radioactivity in order to find high indicative dose concentrations of sodium. Results from analyses of over 2000 samples indicate: (1) measurements of sodium concentration alone are useful in supplementing other diagnostic results; (2) sodium concentration measurement by neutron activation analysis only are not dependable; (3) measurements of sodium potassium concentration ratios can be used to detect external sodium contamination; (4) sodium contained in fingernails issues from the sweat glands located beneath the nails; and (5) sodium concentration in nails varies with age and is most pronounced in the first days of life. G.G.

N70-15246# Commissariat a l'Energie Atomique, Grenoble (France). Lab. de Biologie Vegetale.

ACTIVATION ANALYSIS IN PLANT BIOLOGY. RADIOECOLOGICAL APPLICATIONS USING SIMPLE OR AUTOMATED RADIOCHEMICAL SEPARATION TECHNIQUES

A. Fourcy, M. Neuburger, C. Garrec, A. Fer, and J. P. Garrec *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 160–169 refs (See N70-15226 04-06)

Avail: SOD $8.50

Proposed is an activation analysis for plant radioecology that uses semi-automatic radiochemical separation after radioactivation and NaI(Tl) detection for simultaneous determination of natural trace elements as well as on aquatic ecosystems enriched with ruthenium or cesium. Irradiated plant samples are dry ashed, dissolved, and undergo radiochemical separation by fractional elution. Elements are collected as a whole in one fraction and identified by gamma spectrometry. A distillation process is used to separate ruthenium from the aquatic ecosystem. G.G.

N70-15247# Food and Drug Administration, Washington, D.C.
DETERMINATION OF VANADIUM BY NEUTRON ACTIVATION ANALYSIS AT NANOGRAM LEVELS IN DIETS FOR EXPERIMENTAL ANIMALS
J. P. F. Lambert and R. E. Simpson *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 170–176 refs (See N70-15226 04-06)
Avail: SOD $8.50

Evaluated was the neutron activation method for determining vanadium at nanogram levels and its application to the survey of vanadium in animal diets and diet ingredients. Samples were charred, irradiated and then dissolved for quantitative transfer and separation extraction of vanadium. A NaI(Tl) detector was used to record the sample's gamma-ray activity as well as standard vanadium activity. Vanadium content of the sample was then determined by comparing the net integrated count under the 1.43 MeV photopeak of V-52 in the sample with that recorded for the vanadium standard. G.G.

N70-15248# Washington State Univ., Pullman. Dept. of Chemistry.
THE INSTRUMENTAL DETERMINATION OF FIFTEEN ELEMENTS IN PLANT TISSUE BY NEUTRON ACTIVATION ANALYSIS
William A. Haller, Royston Filby, Louis A. Rancitelli, and John A. Cooper *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 177–183 refs Prepared in cooperation with Battelle-Northwest (See N70-15226 04-06)
Avail: SOD $8.50

Described is a method for relating trace element concentrations to environmental or biological parameters by neutron activation analysis. Plant tissue samples were irradiated and allowed to decay before gamma-ray analysis. A solid state Ge(Li) spectrometer was then used to measure short-lived activation products at various time intervals as well as after a certain time long-lived activation products. Neutron activation standards were counted at appropriate intervals and compared with samples in order to determine the decay characteristics of the neutron induced radionuclides. G.G.

N70-15249# Nuclear Research Center, Athens (Greece). Chemistry Div.
SIMULTANEOUS DETERMINATION OF ARSENIC, ANTIMONY AND MERCURY IN BIOLOGICAL MATERIALS BY NEUTRON ACTIVATION ANALYSIS
I. Hadzistelios and A. P. Grimanis *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 184–189 refs (See N70-15226 04-06)
Avail: SOD $8.50

The neutron activation analytical method described for simultaneous determination of arsenic, antimony, and mercury in biological materials uses a combined solvent extraction-ion exchange procedure to isolate irradiated arsenic, antimony, and mercury in steps and to compare their gamma-ray activities with standards of known activity. Chemical yields were found by comparing corresponding sample photopeak areas of As-76, Sb-122, and Hg-197 with reactivation standards. G.G.

N70-15250# Kentucky Univ., Lexington. Dept. of Chemistry.
INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF TOBACCO PRODUCTS
R. A. Nadkarni and W. D. Ehmann *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 190–196 refs Sponsored by US Dept. of Agr. (See N70-15226 04-06)
Avail: SOD $8.50

Current interest in the production of tobacco and the physiological effects of human consumption of tobacco, make it desirable to study the inorganic microelements in tobacco products. In view of the number of elements of suspected toxicity present in tobacco this study is of singular interest. The techniques used in this study may also be applied to trace element analyses in a wide variety of biological matrices. In this study instrumental neutron activation analysis (INAA) utilizing a high resolution Ge(Li) detector has been employed. This detector permits resolution and characterization of close lying gamma-ray energies. The work presented here is confined to the abundances of 11 elements in tobacco. The studies on the transferrence of these elements into smoke and residual ashes will be reported at a later date. Author

N70-15251# Nuclear Research Center, Athens (Greece). Chemistry Div.
SIMULTANEOUS DETERMINATION OF ARSENIC AND COPPER IN WINES AND BIOLOGICAL MATERIALS BY NEUTRON ACTIVATION ANALYSIS
Apostolos P. Grimanis *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 197–202 refs (See N70-15226 04-06)
Avail: SOD $8.50

Irradiated wine samples underwent radiochemical extraction for separation of arsenic and copper trace elements and the solutions were then compared to copper and arsenic standards treated in a similar manner. Volumetric flasks containing the copper and arsenic solutions isolated from the irradiated samples were evaluated by NaI(Tl) crystal scintillator for radiochemical purity by determining the half lives of Cu-64 and As-76. Chemical yields of trace materials were than determined by reactivation; they averaged for copper 75 and for arsenic 80 percent. G.G.

N70-15252# Aktiebolaget Atomenergi, Nykoping (Sweden).
ASPECTS OF LOW TEMPERATURE IRRADIATION IN NEUTRON ACTIVATION ANALYSIS
Deg Brune *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 203–206 refs (See N70-15226 04-06)
Avail: SOD $8.50

Neutron irradiation of the sample while frozen in a cooling device inserted in a reactor channel has been carried out in the analysis of iodine in aqueous samples as well as of mercury in biological tissue and water. The low temperature irradiation technique is in this case adequate for an accurate analysis, inasmuch as iodine is easily evaporated, especially from acid solutions. Iodine is also adsorbed onto plastic containers. Evaporation effects of mercury are strongly pronounced for water solutions and seem to be dependent on the water quality. As regards neutron activation of several aqueous or tissue samples close together, mutual flux perturbation effects may occur giving rise to heterogeneous activation. Such disturbances can, however, be corrected. Similarly a large aqueous or tissue sample gives rise to flux disturbances. Using a special geometrical arrangement during the multiple sample irradiation process as here described the mutual flux perturbation effect can be eliminated. Author

N70-15253# Atomic Energy Commission Research Establishment, Riso (Denmark). Isotope Lab.
DETERMINATION OF THE SPECIFIC ACTIVITY OF COMMERCIAL IODINE-125 PREPARATIONS BY NEUTRON ACTIVATION ANALYSIS
K. Heydorn *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 207–211 refs (See N70-15226 04-06)
Avail: SOD $8.50

Aqueous solutions of iodine-125 were analyzed for unknown decomposition compounds by irradiating aliquot samples, determining their initial I-126 content and then keeping the samples in a freezer at −20 deg until the I-125 : I-126 ratio was greater than 400. Samples were then counted again and their total activity measured before they underwent irradiation followed by counting

and recounting at preselected decay times. The resulting difference spectrum was evaluated for the 386 keV photopeak from I-126 to be compared with the standard. All disintegration rates were corrected at the end of irradiation assuming an I-126 half life of 12.8 days. G.G.

N70-15254# Technische Hochschule Munchen (West Germany). Inst. fur Radiochemie.

INVESTIGATIONS ON THE AGE AND PLACE OF ORIGIN OF PAINTINGS BY NEUTRON ACTIVATION ANALYSIS

F. Lux, L. Braunstein, and R. Strauss *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 216-225 refs Sponsored by Deut. Forsch.-Gemeinschaft (See N70-15226 04-06)

Avail: SOD $8.50

Neutron activation analysis was applied to the scientific investigation of old paintings. Samples of white lead underwent short as well as long irradiation and the formed radionuclides of trace elements were determined by a combination of radiochemical separation and gamma spectrometry; the lead percentage of the samples was analized by anoding stripping polarity. Differences in silver and antimony percentages observed were important for conclusions relating to the history of art. A tentative correlation between different types of white lead and period of origin is presented in table form. G.G.

N70-15255# United Kingdom Atomic Energy Authority, Wantage (England). Research Lab.

AN INVESTIGATION OF THE SILVER CONTENT OF ROMAN COINAGE BY NEUTRON ACTIVATION ANALYSIS

D. Gibbons and D. Lawson *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 226-229 refs (See N70-15226 04-06)

Avail: SOD $8.50

A selection of silver coins have been examined by neutron activation analysis in order to determine their silver content. Coins were irradiated with interleaved thin silver foil standards and silver contents were calculated by comparing coin activities with the mean of the activities of the foils on either side. Ge(Li) and Na(Tl) semiconductor gamma-ray spectrometers were used to count the 0.66 and 0.89 MeV silver activities and the silver content was expressed as the mean of the two results. G.G.

N70-15256# Institute for Nuclear Physics Research, Amsterdam (Netherlands).

NONDESTRUCTIVE ACTIVATION ANALYSIS OF ANCIENT COINS USING CHARGED PARTICLES AND FAST NEUTRONS

P. Meijers *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 230-245 refs Sponsored by Found. for Fundamental Res. on Matter and Neth. Organ. for Pure Sci. Res. (See N70-15226 04-06)

Avail: SOD $8.50

A description is given of the nondestructive determination of copper and silver in gold coins, copper, gold and lead in silver coins and iron, nickel, zinc, arsenic, tin, antimony and lead in copper coins. Irradiation was performed in the extracted beam of the synchrocyclotron. Gold and silver coins were irradiated with 30 MeV protons and 26 MeV deuterons, respectively, copper coins with fast neutrons. Fast neutron irradiation could be achieved by placing a 2.6 mm thick beryllium disc (diameter 15 cm) in the 26 MeV deuteron beam of at the end of the beam pipe. Weight fraction calculations for the elements determined established the lower detection limits for copper and silver in gold coins as 0.005 and 0.05 percent, respectively. For copper, gold, and lead in silver coins the lower detection limits are 0.01, 0.1, and 0.1 percent, respectively. All count rates were corrected for gamma self-absorption. Author

N70-15257# Brookhaven National Lab., Upton, N.Y. Chemistry Dept.

THE ANALYSIS OF ENGLISH AND AMERICAN POTTERY OF THE AMERICAN COLONIAL PERIOD

Jacqueline S. Olin and Edward V. Sayre *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 246-250 refs Sponsored by AEC (See N70-15226 04-06)

Avail: SOD $8.50

This study was conducted to determine whether pottery manufactured in England during the 17th century shows compositional uniformity and can be distinguished from American potsherd compositions. Samples were analyzed nondestructively by neutron activation with gamma-ray spectrum measurements with lithium-drifted germanium detectors. The elements determined were scandium, lanthanum, europium, cerium, thorium, iron, and cobalt. All concentrations were reported as equivalent concentrations of oxides except iron oxide, which was a major component present to about 10 percent. Statistical evaluation of all data revealed that although most of the specimens from American sites agreed in composition with those from English sites and in all probability were imported, several of them, particular two from California, show significant compositional differences in several elements. G.G.

N70-15258# Internal Revenue Service, Washington, D.C. Alcohol and Tobacco Tax Div.

COMPARISON OF FORENSIC SOIL SPECIMENS BY NEUTRON ACTIVATION ANALYSIS

C. M. Hoffman, R. L. Brunelle, K. B. Snow, and M. J. Pro *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 251-255 refs (See N70-15226 04-06)

Avail: SOD $8.50

The elemental distribution in soils selected from three areas of the United States was studied by neutron activation and gamma-ray spectrum measurements with NaI(Tl) detectors. Samples collected from Georgia, Texas, and Washington varied in their concentrations of some elements while others remained more uniform; soils taken within a 100 ft radius were found similar in trace element composition but quantitative and qualitative variations increased as the radius enlarged. G.G.

N70-15259# Centre of Forensic Sciences, Toronto (Ontario).

RECENT FORENSIC APPLICATIONS OF INSTRUMENTAL ACTIVATION ANALYSIS

Auseklis K. Perkons and Robert E. Jervis *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 256-264 refs Prepared in cooperation with Toronto Univ. (See N70-15226 04-06)

Avail: SOD $8.50

The development and introduction of high resolution solid state radiation detector systems in the field of activation analysis has resulted in significant advances in the use of nondestructive trace characterization of evidence materials involved in forensic investigations. The enhanced resolution of the detectors has enabled the forensic scientist to measure a sufficient number of significant trace characteristics in a small sample to be able to individualize similar exhibits, determine the origin or history of questioned exhibits, or identify traces of foreign substances in various materials without having to resort to lengthy and destructive radiochemical separation procedures of sophisticated techniques of gamma-ray spectrum analysis. This paper lists some of the recent advances in forensic activation analysis (FAA) and presents data proving the feasibility of improved forensic applications of the technique in a variety of investigations. Author

N70-15260# Gulf General Atomic, San Diego, Calif.

THE EXAMINATION OF ACTUAL CASE EVIDENCE SAMPLES BY NEUTRON ACTIVATION ANALYSIS

H. L. Schlesinger, H. R. Lukens, and D. M. Settle *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969

p 265–271 refs (See N70-15226 04-06)
Avail: SOD $8.50

Forensic activation analysis is used to characterize hair, gunshot residues, bullet lead comparison, pigment of paintings, and alleged poisoning of animals. The major difficulty encountered on this work centers around the problems of proper sampling and interpretation of the results. G.G.

N70-15261# Reactor Instituut, Delft (Netherlands).
ARSENIC CONTENT OF HUMAN HAIR AFTER WASHING AS DETERMINED BY ACTIVATION ANALYSIS
A. J. van den Berg, J. J. M. de Goeij, J. P. W. Houtman, and C. Zegers *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 272–282 refs (See N70-15226 04-06)
Avail: SOD $8.50

Evaluated was the connection between arsenic desorption from human hair and original absorption by either metabolic processes or outside contamination. Selected washing procedures have shown that the part of arsenic incorporated in the medulla by metabolic processes was less easily washed out than arsenic introduced from the outside less strongly bound in the form of ions to active groups. Neutron activation analysis followed by gamma-ray spectrometry showed that in various types of washed hair a treatment with pure water at 76 C could obscure relatively small differences in behavior of arsenic introduced by different paths. G.G.

N70-15262# Virginia Univ., Charlottesville.
COMPARISON OF ACTIVATION ANALYSIS AND SPARK SOURCE MASS SPECTROMETRY FOR FORENSIC APPLICATIONS
T. G. Williamson and W. W. Harrison *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 283–287 refs Sponsored by Office of Law Enforcement Assistance (See N70-15226 04-06)
Avail: SOD $8.50

Neutron activation analysis and spark source mass spectrometry are being compared with respect to characterization of hair samples, precision and reproducibility of data, amount of sample required, sample handling, and time for analysis. Typical results from spark-source mass spectrometry on several different hair samples are shown and the weight concentrations of 22 identified elements are tabulated. A reasonable agreement is observed for results from both methods, with the exception of manganese values which seem to indicate hydrocarbon interference in the mass spectrometer data. G.G.

N70-15263# Reactor Centrum Nederland, Petten.
ROUTINE DETERMINATIONS OF Al, K, Cr, AND Sn IN GEOCHEMISTRY BY NEUTRON ACTIVATION ANALYSIS
H. A. Das, J. G. van Raaphorst, and H. J. L. M. Umans *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 291–301 refs (See N70-15226 04-06)
Avail: SOD $8.50

The routine determinations performed as a service to geologists are listed in table form. All neutron activation analyses start with samples of 100 to 200 mg, except that of potassium. Two of the procedures discussed here in more detail are those for aluminuma and potassium. In the former analysis there is the problem of correcting for the variation of the total dead time during measurement. The determination of potassium is carried out by beta measurements on small samples (20 to 30 mg) with standardized counting equipment. Author

N70-15264# Wien Univ. (Austria).
DETERMINATION OF TRACE ELEMENTS IN METEORITES BY NEUTRON ACTIVATION ANALYSIS
Wolfgang Kiesl *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 302–307 refs (See N70-15226 04-06)
Avail: SOD $8.50

A quantitative determination of about 47 elements in meteorites was performed. About 15 of these elements, namely main constituents and minor elements, were determined by wet chemistry while the assay of the others was performed using activation analysis and mass spectrometry. For isotopes with half-lives exceeding 24 hours an analytical scheme has been developed; for this purpose, about 100 to 200 mg of each meteorite sample was irradiated together with the standards of the elements to be determined. This was followed by chemical distillation and ion exchange procedures for element separation and final isotope photopeak identifications. Results for calculated abundances indicate a high temperature origin for terrestrial planets and a low temperature formation for giant planets and carbonaceous chondrites of type I and II. G.G.

N70-15265# Kentucky Univ., Lexington. Dept. of Chemistry.
THE NONDESTRUCTIVE DETERMINATION OF IRIDIUM IN METEORITES USING GAMMA-GAMMA COINCIDENCE SPECTROMETRY
W. D. Ehmann and D. M. McKown *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 308–314 refs (See N70-15226 04-06)
(Contract AT(40-1)-2670)
Avail: SOD $8.50

A nondestructive procedure for the determination of Ir in meteorites containing at least 0.1 parts per million (ppm) Ir has been developed utilizing neutron activation followed by gamma-gamma coincidence spectrometry. The procedure eliminates problems associated with the radiochemical separation of Ir. Errors due to preirradiation contamination, irradiation variables, and the coincidence counting arrangement must be evaluated, however, in order to establish validity of such data. This nondestructive technique may then be used to evaluate the various chemical procedures previously employed. Author

N70-15266# Institutt for Atomenergi, Kjeller (Norway).
DETERMINATION OF SOME RARE EARTHS IN ROCKS AND MINERALS BY NEUTRON ACTIVATION AND GAMMA-GAMMA COINCIDENCE SPECTROMETRY
O. B. Michelsen and E. Steinnes *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 315–319 ref (See N70-15226 04-06)
Avail: SOD $8.50

In connection with an investigation of potential sources of rare earth elements in Norway the need arose for simple and accurate methods for the determination of these elements in a great number of samples, mainly rocks and minerals. It was decided to try gamma-gamma coincidence spectrometry following neutron activation of the samples. In this work we have primarily concentrated on Eu, first because it proved difficult to determine in the actual samples by other instrumental techniques, and second because this element is in the focus of interest for commercial reasons. A routine method for the determination of Eu, based on the 9.3 h Eu-152 is presented. Measurements based on the 12 y Eu-152 have also been tried with satisfactory results. In addition preliminary experiments on the determination of La, Sm, Tb, Yb, and Lu are described. Author

N70-15267# Bhabha Atomic Research Centre, Bombay (India). Analytical Div.
NEUTRON ACTIVATION METHOD FOR THE ISOTOPIC ANALYSIS OF LEAD
P. P. Parekh, M. Sankar Das, and V. T. Athavale *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 320–326 refs (See N70-15226 04-06)
Avail: SOD $8.50

The attainable precision in the analysis of lead-208 to lead-204 ratio was evaluated with a view to determine the model ages of galenas. Samples and standards were adjusted so that the recorded activity in a 2 min period was between 50,000 and 100,000 counts with errors from counting statistics lower than 0.44 percent and errors from beta counting of lead-209 minimized. Purified galena powder and standards were irradiated, underwent chemical separation procedures and were weighted before their radioactive dating was undertaken. Model ages obtained from lead-208 to lead-204 values are presented in tables. G.G.

N70-15268# Geological Survey, Denver, Colo.
DETERMINATION OF PROTACTINIUM BY NEUTRON ACTIVATION AND ALPHA SPECTROMETRY
J. N. Rosholt and B. J. Szabo *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 327–333 refs (See N70-15226 04-06)
Avail: SOD $8.50

Developed is an activation technique for protactinium analysis in which protactinium-231 is partially transformed into uranium-232 by thermal neutrons. Thus a good intrinsic flux monitor is provided when the uranium-238/thorium-232 ratio in the sample is determined by the isotope dilution method. Activity factor ratios and flux factors for granite reference samples containing uranium and thorium are given. G.G.

N70-15269# Rikkyo Univ., Yokosuka (Japan). Inst. for Atomic Energy.
USE OF A Ge(Li) DETECTOR AFTER SIMPLE CHEMICAL GROUP SEPARATION IN THE ACTIVATION ANALYSIS OF ROCK SAMPLES. PART 4: SIMULTANEOUS DETERMINATION OF STRONTIUM AND BARIUM
H. Higuchi, K. Tomura, H. Takahashi, N. Onuma, and H. Hamaguchi *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 334–338 refs Prepared in cooperation with Tokyo Univ. (See N70-15226 04-06)
Avail: SOD $8.50

Described is the rapid simultaneous determination of strontium and barium in a number of rock samples by using Ge(Li) detectors after short sample irradiation and fast chemical group separation by conventional precipitation methods. Strontium and barium abundances found in the six rocks are summarized in table form. G.G.

N70-15270# Washington State Univ., Pullman.
ACTIVATION ANALYSIS OF GEOCHEMICAL MATERIALS USING Ge(Li) DETECTORS
Royston H. Filby and William A. Haller *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 339–346 refs (See N70-15226 04-06)
Avail: SOD $8.50

The work described in this paper was undertaken to extend the range of elements which may be determined in rocks, minerals, and meteorites. To include nuclides with half lives in the range 2 minutes to 40 hours, the method developed consists of three parts. Short neutron irradiation of samples and standards followed by rapid transfer to the counting system permits the determination of Al, Mn, Na, V, Ti, Ca, and in certain cases, Mg, in rocks and meteorites. Long irradiation followed by a one month decay period allows the determination of Sb, Co, Zn, Sc, Cr, Eu, Th, U, Ba, Ta, and Fe. The high Na-24 activity in most irradiated silicate rocks and meteorites masks several activation products of interest. A method has been developed for the determination of these nuclides by the dissolution of the irradiated sample followed by removal of Na-24 on a sodium specific inorganic ion-exchanger. The separation of Na-24 is simple and negligible adsorption of other elements of interest has been observed. Author

N70-15271# Oregon Univ., Eugene. Center for Volcanology.
Ge(Li) DETECTORS IN THE ACTIVATION ANALYSIS OF GEOLOGICAL SAMPLES
Keith Randle and Gordon G. Goles *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 347–352 refs (See N70-15226 04-06)
Avail: SOD $8.50

A 30 cubic centimeter coaxial lithium-drifted germanium detector was used to obtain a number of abundances in irradiated silicic and basic rocks. The resolution of the detector was about 5.6 keV for the 1333 keV gamma rays of Co-60. Identification of observed gamma-rays was based largely on the energies of the lines and the decay schemes of the isotopes involved. Production and properties of nuclides observable with Ge(Li) detectors are listed. Significant improvement in detector sensitivity was obtained by the use of an anti-Compton shield and by employing NaI(Tl)-Ge(Li) coincidence measurements. G.G.

N70-15272# Stockholm Univ. (Sweden). Aktiebolaget Atomenergi, Stockholm (Sweden). Dept. of Quaternary Research.
AN INVESTIGATION OF TRACE ELEMENTS IN MARINE AND LACUSTRINE DEPOSITS BY MEANS OF A NEUTRON ACTIVATION METHOD
O. Landstrom, K. Samsahl, and C. G. Wenner *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 353–366 refs Prepared in cooperation with Aktiebolaget Atomenergi (See N70-15226 04-06)
Avail: SOD $8.50

Activation multielemental analysis, chemical separation methods, and gamma-ray spectroscopy were used to identify trace elements in marine and lacustrine deposits in a coastal valley in Sweden. Statistical evaluation of the results showed that in the most marine layer of the post-glacial transgression, bromine had significantly higher values than in all other layers. Arsenic did not show any correlation with increasing salinity; antimony was higher in the brackish marine layer than in those of younger fiords and fresh water layers of an ancient lake. G.G.

N70-15273# Texas A&M Univ., College Station. Activation Analysis Research Lab.
GEOCHEMICAL SURVEYING BY MEANS OF NEUTRON ACTIVATION ANALYSIS WITH POSSIBLE APPLICATION TO CONTINENTAL DRIFT STUDIES
Ernst A. Uken, Gabriel G. Santos, and Richad E. Wainerdi *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 367–378 refs (See N70-15226 04-06)
Avail: SOD $8.50

The feasibility of applying activation analysis to geological mapping procedures was investigated by measuring the induced gamma-ray activity in granite samples from an area which had been adequately mapped and from which geological and analytical data were available. Observed spectra were analyzed for rates of peak decay and secondary peak energies to yield quantitative values for Fe, Sc, Co, La, Eu, Hf and Ta. The symmetry of the elemental trends was in good agreement with mapped zonal area arrangement of the various rock types. Compositional trends seemed to extend beyond the plateau boundary irrespective of host rock type. G.G.

N70-15274# Texas A&M Univ., College Station. Activation Analysis Research Lab.
VOLCANOLOGICAL STUDIES USING ACTIVATION ANALYSIS TECHNIQUES
Gabriel Santos and Richard E. Wainerdi *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 379–387 refs (See N70-15226 04-06)
Avail: SOD $8.50

Volcanic ash materials, a volcanic bomb, and fragments of olivine-bearing basaltic rock from a recent volcano eruption were collected and analyzed by activation-gamma-ray spectroscopy for their produced radionuclides. The Cu/Na ratio was used as base

throughout this study because their product radionuclides had prominent characteristic gamma-rays. The similarity of the Cu/Na ratios in the basalt, volcanic bomb, and volcanic ash samples seemed to indicate that the recent eruption was caused in part by the mixing of heated ground or lake water with magnetic material. G.G.

N70-15275# Pavia Univ. (Italy). Laboratorio di Radiochimica.
ALUMINUM AND SILICON ABUNDANCES OF SOME ITALIAN METEORITES AS DETERMINED BY INSTRUMENTAL ACTIVATION ANALYSIS
Sandro Meloni, Vera Maxia, and Silvano Buzzi *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 388–394 refs (See N70-15226 04-06)
Avail: SOD $8.50

Silicon and aluminum determination in rocks and meteorites by neutron activation analysis has been proposed. Silicon is determined by irradiation with 14 MeV neutrons through the reaction Si-28 to Al-28 and aluminum by irradiation with thermal neutrons through the reaction Al-27 to Al-28. The results obtained by neutron activation are quite precise and accurate, and the analyses may be performed in a short time. Furthermore, using instrumental neutron activation, the peculiar advantage is obtained of allowing the meteorite samples to be available for further investigations. In this work aluminum and silicon have been determined in eight meteorites by using pile neutrons and irradiating the meteorite samples in two different positions of the reactor. Author

N70-15276# Geological Survey, Denver, Colo.
NEUTRON ACTIVATION ANALYSIS OF INDIVIDUAL COSMIC SPHERULES
H. T. Millard, Jr. *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 395–398 refs (See N70-15226 04-06)
Avail: SOD $8.50

Neutron activation and gamma spectrometric analyses were performed on spherules found in deep oceanic sediments to determine their possible cosmic origin. Concentrations of nickel, cobalt, manganese, and iridium measured in the spherules were normalized to the concentration of iron in each sample in order to reconstruct the unoxidized composition of the spherules and for comparison with known data for iron meteorites and terrestrial materials. The spherules were divided into two groups: (1) low manganese, high iridium, and high specific gravity; and (2) high manganese, probably low iridium, and low specific gravity. The first group was considered to be from iron meteorites whereas those in the second group probably were terrestrial in origin. G.G.

N70-15277# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
EXTENSIONS OF THE USE OF Ge(Li) DETECTORS IN INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF GEOLOGICAL SAMPLES
G. E. Gordon, J. C. Dran, P. A. Baedecker, and C. F. L. Anderson *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 399–403 refs (See N70-15226 04-06)
(Contract AT(30-1)-905)
Avail: SOD $8.50

Neutron activation followed by gamma-ray spectroscopy with Ge(Li) detectors at time intervals on rocks and meteoric samples was used to determine concentrations of short-lived radionuclides and concentrations of aluminum, magnesium, and vanadium. Except for short-lived species Al-28 and, in meteorites and ultramafic rocks vandium-52 and magnesium-27, no new species were observed. G.G.

N70-15278*# IIT Research Inst., Chicago, Ill.
NEUTRON TECHNIQUES FOR IN SITU ELEMENTAL ANALYSIS
John W. Mandler and John H. Reed *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 404–408 refs Sponsored jointly with NASA, Lawrence Radiation Lab., Mobil Oil, and Texas A&M Univ. (See N70-15226 04-06)
Avail: SOD $8.50

Capture, inelastic, and activation gamma-ray spectra from large samples of basalt and granite have been obtained using Pu-Be neutron source and NaI(Tl) and Ge(Li) detectors. The pulsed nature of the source permits the separation of the inelastic, capture, and activation portion of the spectrum. The combined spectrum for basalt using a NaI(Tl) detector contained identifiable lines from iron, titanium, calcium, silicon, and hydrogen and cyclic activation gamma rays from oxygen and silicon. The inelastic spectrum contained lines attributed to sodium, iron, magnesium, aluminum, silicon, and oxygen. Data collected by using a Ge(Li) detector together with a pulsed neutron source offered little advantage over the use of an isotopic source. G.G.

N70-15279*# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
SIMULTANEOUS MEASUREMENT OF SEVENTEEN TRACE ELEMENTS IN EIGHT GEOCHEMICAL STANDARDS: A NOVEL ADAPTATION OF NEUTRON ACTIVATION ANALYSIS
D. R. Case, J. C. Laul, M. A. Wechter, F. Schmidt-Bleek, and M. E. Lipschutz *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 409–412 Sponsored in part by NASA (See N70-15226 04-06)
(Grant NSF GA-1474)
Avail: SOD $8.50 CSCL 07D

The geochemical and geothermal history of stony meteorites was studied by measuring their contents of 17 elements by using neutron activation and high-resolution gamma-ray detectors, a reirradiation technique for chemical yield determination, and computer analysis for data reduction. Application of this method to the analysis of geochemical standards generated a vast quantity of data which were analyzed by computer. G.G.

N70-15280# Institute of Nuclear Techniques, Krakow (Poland).
ON THE FEASIBILITY OF THE DETERMINATION OF WATER, SALT AND SULPHUR IN CRUDE OIL BY MEANS OF NEUTRON ACTIVATION ANALYSIS
L. Gorski, J. Janczyszyn, and L. Loska *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 420–429 refs (See N70-15226 04-06)
(Contract IAEA-375/RB)
Avail: SOD $8.50

Contaminations of crude oil can be determined by means of activation analysis with 14 MeV neutrons. The contents of the particular contaminants in crude oil imported by Poland are the following: NaCl contents: small–25 mg/liter, average–250 mg/liter; exceptionally high–1500 mg/liter; H2O average–6 g/liter; S average–15 g/liter. Continuous determination of these contaminations can be carried out. Author

N70-15281# United Kingdom Atomic Energy Authority, Wantage (England). Research Lab.
INVESTIGATION OF MATERIAL TRANSFER BY NEUTRON ACTIVATION ANALYSIS
D. Gibbons, D. Lawson, B. Metcalfe, and H. Simpson *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 430–436 refs (See N70-15226 04-06)
Avail: SOD $8.50

Activation analysis and inactive tracer methods were used to measure transferred elements in printing ink, bearing wear, and coal grinding machinery wear. To organic ink an activable tracer was added. Wear in lead-indium shell bearings was measured by the indium content in the lubricating oil after activation followed by Ge(Li) gamma-ray spectroscopy. It was revealed that oil filters in engines which might have influenced results by removing solid

wear products, in practice plug up very early in a typical automobile engine and are then bypassed and are effectively out of the system. Radiochemical separation procedures were necessary for reliable gamma spectroscopy in order to identify wear elements in coal grinding machines. G.G.

N70-15282# Louisiana State Univ., Baton Rouge.
APPLICATIONS OF ACTIVATION ANALYSIS TO DETERMINATION OF CEMENT IN CONCRETE
F. A. Iddings and Ara Arman *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 437–443 refs (See N70-15226 04-06)
Avail: SOD $8.50

Samples of cement, concrete, sand and sand aggregate, soil, and soil-cement mixtures were activated by 14 MeV neutrons from the accelerator or by thermal neutrons from the nuclear reactor. A variety of activation, decay, and count times were used in an unsuccessful effort to discover a unique component in cement that would offer a good method for activation analysis. The feasibility of using a portable fast neutron generator and counting equipment in the field was demonstrated on cement highway by the determination of induced aluminum-28 activity from the Si-28(n,p) Al-28 reaction. G.G.

N70-15283# Naval Ordnance Station, Indian Head, Md.
DETERMINATION OF SODIUM AND POTASSIUM IN SOLID PROPELLANTS
W. H. Barber, O. H. Dengel, R. H. Vogt, and C. V. Strain *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 333–449 refs Prepared in cooperation with NRL (See N70-15226 04-06)
Avail: SOD $8.50

Eight batches of solid missile propellant were analyzed for sodium and potassium content by thermal neutron activation and gamma-ray spectrometer analysis. A special thermal column was designed and used to suppressed aluminum isotope interference. A Ge(Li) solid state detector of 40 cubic centimeter volume with a resolution of 4.7 keV and a multichannel analyzer were utilized to resolve the Na-24 and K-42 peaks. Results of the study were normalized for decay, weight, duration of irradiation, and are presented in a table. G.G.

N70-15284# Helsinki Univ. (Finland). Reactor Lab.
THE APPLICATION OF ISOTOPIC NEUTRON SOURCES TO CHEMICAL ANALYSIS FOR PROCESS CONTROL IN THE METALLURGICAL INDUSTRY
J. Kuusi *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 450–456 refs (See N70-15226 04-06)
Avail: SOD $8.50

Neutron activation analysis was used in the mining industry to monitor Al-28 and V-52 after 10 min. activation of 430 ml samples with a 3 curie Am-241 Be neutron source. This equipment can follow the silicon concentration of chromium ore as well as its chromium content and is capable of analyses with a 3 percent relative error. A NaI detector for gamma counting and a multichannel pulse-height analyzer were utilized. G.G.

N70-15285# General Telephone and Electronics Labs., Inc., Bayside, N.Y. Research Center.
ROUTINE DETERMINATION OF MAJOR COMPONENTS BY ACTIVATION ANALYSIS
James F. Cosgrove *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 457–459 refs (See N70-15226 04-06)
Avail: SOD $8.50

Neutron activation and gamma-ray spectroscopy with a sodium-iodide crystal detector coupled to a multichannel analyzer was used to determine the composition of thin films. Stoichiometric composition of silicon dioxide, aluminum oxide, and mixed oxide films was found simultaneously by evaluating photopeak areas in relative short time. G.G.

N70-15286# Dow Chemical Co., Midland, Mich. Radiochemistry Research Lab.
INSTRUMENTAL NEUTRON ACTIVITY ANALYSIS USING REACTOR, Ge(Li) DETECTOR AND COMPUTER
Oswald U. Anders *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 460–465 refs (See N70-15226 04-06)
Avail: SOD $8.50

Instrumental activation analysis was developed into a general qualitative and quantitative analytical system capable of identifying up to ten elements simultaneously and proving quantitative assays from a single activation without chemical separations. The high resolution of the germanium detector makes it unnecessary to fit the peaks to a Gaussian curve for analysis. Relatively high gain stability of the spectrometer makes it unnecessary to gainshift the data and composite peaks with unresolved maxima and two different half lives do not have to be considered specially, since they do not occur with sufficient frequency. It is sufficient to consider Compton continua in the region of a photopeak as a base upon which the photopeak is superimposed and to approximate the continuum by a straight line over the channels of the peak. The background as well as pulse-pileup distortions can be treated simultaneously with the Compton continuum except in regions where there are peaks in the background spectrum. The flux is known to about 1 percent standard deviation. The half lives of the isotopes giving gamma ray peaks are assumed to be known exactly from the literature or other sources. Author

N70-15287# Institute of Science, Bombay (India). Inorganic and Nuclear Chemistry Lab.
SUBSTOICHIOMETRIC DETERMINATION OF MOLYBDENUM AND PALLADIUM BY NEUTRON ACTIVATION ANALYSIS
Z. K. Doctor, R. A. Nadkarni, and B. C. Haldar *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 468–472 refs (See N70-15226 04-06)
Avail: SOD $8.50

Described is the substoichimetric determination of microgram amounts of palladium by neutron activation involving extraction of palladium with isonitrosoacetophenone. An artificial mixture containing Fe, Cr, Ni, Co, Mn, and traces of P, S, and Mo, a standard, and an alloy steel were analyzed for Mo by the proposed method. Results were in good agreement with elsewhere reported values. Analysis of a synthetic mixture containing 2.0 microgram of Pd and 20 to 200 micrograms of each Ru, Rh, Os, Ir, Pt, Ag, and Au also gave good results; adequate decontamination of Pd from these elements was obtained by irradiation for two hours. G.G.

N70-15288# Atomic Energy Establishment, Cairo (Egypt). Analytical Div.
ACTIVATION ANALYSIS BY STANDARD ADDITION AND SOLVENT EXTRACTION. DETERMINATION OF CERTAIN TRACE ELEMENTS IN ANTIMONY
A. Alian *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 473–474 refs (See N70-15226 04-06)
Avail: SOD $8.50

Activation of an antimony sample was followed by complete dissolution, chemical extraction of the induced isotope, and comparison with standard solution for simultaneous determination of trace elements. Induced Sb-122 and Sb-124 isotopes were separated by extraction with isopropyl ether; while the isotopes from elements to be determined were fractionated by extraction with various reagents. G.G.

N70-15289# European Atomic Energy Community, Ispra (Italy). Joint Research Center.

NONDESTRUCTIVE DETERMINATION OF ELEMENTS IN SPECIFIC FRESHWATER MICROPLANKTON BY ACTIVATION ANALYSIS

Margaret Merlini, Oscar Ravera, and Carla Bigliocca *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 475–481 refs (See N70-15226 04-06)

Avail: SOD $8.50

Described are methods used in obtaining relatively pure samples of freshwater microplankton and the activation techniques used for the determination of elements in zooplankton and phytoplankton collected from subalpine lakes in Italy. Samples were irradiated and analysis was carried out by gamma spectrometry. Quantitative determinations of Ca and Mn were made by evaluating measured photopeaks for Ca-49 and Mn-56. Na and K were determined the following day using the photopeaks for Na-24 and K-42 on a Ge(Li) detector. Of all the elements determined, the greatest variation was found for K values in all groups. Phytoplankton showed the greatest variations of all elements due to the seasonal changes in the structure and physiology of the biocenosis. The calcium content was found to be independent of the calcium content of the lakes from which samples were obtained. G.G.

N70-15290# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.

ISOTOPIC ANALYSIS OF URANIUM BY NEUTRON ACTIVATION AND HIGH RESOLUTION GAMMA-RAY SPECTROMETRY

M. Mantel, J. Gilat, and S. Amiel *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 482–489 refs (See N70-15226 04-06)

Avail: SOD $8.50

Isotopic ratios U-238/U-235 in a sample of natural uranium were determined from the ratio of the peak intensities of Np-239 formed from U-238 by activation and those of fission products formed from U-235. Several Np-239 peaks, as well as those of a number of fission products were analyzed simultaneously by high resolution gamma-ray spectrometry with Ge(Li) detectors whose output signals were processed by multiple channel analyzer. Comparison of this method with results obtained by neutron activation followed by counting of delayed neutrons gave a precision of about + or − 0.6 percent using all intensity ratios of 21 gamma-ray peaks for a single determination. Very good agreement for the U-235 content was obtained between the two methods with −0.71 percent + or −0.004 by delayed neutron counting versus 0.720 percent + or −0.004 by the above described method. G.G.

N70-15291# Pennsylvania State Univ., University Park. Nuclear Reactor Facility.

PULSED NEUTRON ACTIVATION ANALYSIS SYSTEM FOR SHORT-LIVED RADIOISOTOPES

W. F. Naughton and W. A. Jester *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 490–494 refs (See N70-15226 04-06)

Avail: SOD $8.50

Modification of an existing pulsing reactor pneumatic transfer system with a slotted circular stainless steel knife edge allowed the immediate passage of the irradiated sample and its container to the detector position via the intershield terminus assembly and thus made it possible to measure irradiation time, decay time, and count time of each irradiated sample to a tenth of a second accuracy. This system analyzed quantitatively some fast neutron reactions with short lived products and established limits of detection for these reactions. Preliminary experiments with in-core bare and cadmium lined termini were performed and detection limits obtained through activation by the pulse method are presented for a few short-lived neutron reactions of some of the lower molecular weight elements. G.G.

N70-15292# California Univ., Livermore. Lawrence Radiation Lab.

THE DETECTION AND DETERMINATION OF FISSIONABLE SPECIES BY NEUTRON ACTIVATION: DELAYED NEUTRON COUNTING

James L. Brownlee, Jr. *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 495–500 refs Sponsored by AEC (See N70-15226 04-06)

Avail: SOD $8.50

Gross counting of delayed neutron emitters found among the fission products used to determine short-lived single fissionable species as a function of neutron energy. Two irradiations were performed on each sample, one with and one without cadmium covers. Sensitivities were limited by low epithermal and fast neutron cross sections and by the relatively low epithermal and fast fluxes available in the reactor facility. Preliminary results of the differential irradiation technique for the thermal fissioning species (U-233, U-235, and Pu-239) were obtained through analyzing the differences in delayed neutron group abundances from one species to another by computer matrix reduction of weighted counting data. The program yielded values for each delayed neutron group present in the decay group curve which were then used to generate a series of equations to solve individual values. Results on known mixtures of two fissionable species indicated that an accurate identification of the component fissionable species seems feasible. G.G.

N70-15293# Argonne National Lab., Ill. Chemistry Div.

A HIGH-INTENSITY Am-241/Be/Cm-242 NEUTRON SOURCE

M. Wahlgren, J. Wing, and D. C. Stewart *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, vol. 1, Jun. 1969 p 501–506 refs Sponsored by AEC (See N70-15226 04-06)

Avail: SOD $8.50

A set of eight high intensity isotopic neutron source slugs has been prepared by irradiation of Am-241 Be capsules in the testing reactor to produce Cm-242. At the end of irradiation each capsule emitted approximately 1.2 × to the 10th power neutrons per second. This type of isotopic neutron sources produces a spectrum of unmoderated neutrons primarily in the 4-8 MeV energy range. The new sources and source holder have been designed to given improved geometry for fast neutron irradiations. The capsule and source holder design are described and the features of the irradiation assembly are discussed. The factors considered in selection of irradiation flux and time for production of the source capsule are reviewed. An estimate is presented for the current cost of production of this type of source. The analysis for fluorine by the F-101(n,alpha)N-16 reaction has been studied using the isotopic source and found to be almost interference-free. Optimized sensitivities for 60 chemical elements using the unmoderated source neutrons have been determined. Author

N70-15294# Commissariat a l'Energie Atomique, Grenoble (France).

NEW FACILITIES FOR ACTIVIATION ANALYSIS AT THE GRENOBLE CENTER FOR NUCLEAR STUDIES

J. Laverlochere *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 507–511 (See N70-15226 04-06)

Avail: SOD $8.50

A light water swimming pool reactor was modified by a heavy water tank to improve the ratio of thermal/rapid flux and to lower the heat for activation analysis. Another light water reactor system was modified by placing a short pneumatic tube in the thermal flux for prolonged irradiation times of polyethylene rabbits. Rotation of the rabbits by compressed air improved the precision of analysis and simplified standardization. Characteristics of the irradiation positions planned in the heavy water reactor are described. An accelerator used for 14 MeV and 3 MeV neutron activation analysis obtained 3 × 10000 counts per milligram

oxygen. Installation of a variable energy cyclotron was finished; it is expected to give alphas or protons from 15 to 60 MeV and deuterons from 7 to 30 MeV. Hot cells automatic ion exchange resin, and resin sorting systems for chemical separation were studied for application to activation analyses together with developments in counting and computation equipment. G.G.

N70-15295# Naval Research Lab., Washington, D.C.
THE NUCLEAR ANALYSIS PROGRAM OF THE NRL CYCLOTRON FACILITY
John A. Eisele and Reginald E. Larson *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 512–516 (See N70-15226 04-06)
Avail: SOD $8.50

Described are structure, instrumentation, and projected applications of a 76 inch sector-focused cyclotron that is also capable of accelerating a large variety of ions over a wide range of energies. In addition to pure research in nuclear structure and nuclear reaction physics, service irradiations and isotope production, a materials analysis capability is outlined. The cyclotron is capable of accelerating beams of protons, alpha particles, and helium-3 nuclei. G.G.

N70-15296# Siemens-Schuckertwerke A. G., Erlangen (West Germany).
THE LOCALIZATION OF IMPURITIES IN ACTIVATION ANALYSIS DEMONSTRATED BY ANALYSES OF SEMICONDUCTOR SILICON
J. Martin *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 517–526 refs (See N70-15226 04-06)
Avail: SOD $8.50

Evaluated was the use of combination activation analysis and autoradiography for identifying and locating impurities in silicon semiconductors. Results from various studies on grown crystalline silicon rods indicated that highly sensitive activation analysis should be combined with location of the impurities whenever the activity conditions of matrix substance and impurities are compatible. In cases where the activity of the impurities predominated, autoradiography was preferable; where the activity of the matrix predominated, activation analysis should be combined with chemical separation methods. G.G.

N70-15297# Technical Univ. of Budapest (Hungary). Dept. of Physical Chemistry.
THE DETERMINATION OF COPPER AND GOLD TRACE IMPURITIES IN HIGH PURITY GALLIUM BY ACTIVATION ANALYSIS WITH PRETREATMENT
L. G. Nagy, G. Torok, L. Szokolyi (Natl. Office of Meas., Budapest) and J. Giber (Tungsram Elec. Corp., Budapest) *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 527–535 refs (See N70-15226 04-06)
Avail: SOD $8.50

Described is an activation analysis of copper and gold impurities in gallium which uses distillation for the separation of activated gallium based on the differences in volatility between gallium chloride and the chlorides of possible trace elements. The efficiency of the distillation is characterized by the percentages of the Cu-64 standard and the gallium sample in the residue. Errors in gold and copper determinations by gamma-spectrometry are determined by deviation characteristics in the distillation process. G.G.

N70-15298# Imperial Coll. of Science and Technology, London (England). Dept. of Chemical Engineering.
NEUTRON ACTIVATION ANALYSIS OF LASER CRYSTALS
Ruben F. Ortega *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 536–540 refs Sponsored in part by AEC and Mexican AEC (See N70-15226 04-06)
Avail: SOD $8.50

The possibility of incorporating smaller rare earth elements in flux grown crystals of MgAl-204 spinel structure was studied. Erbium or neodymium oxides were added in various proportions to the initial mixture. Neutron activation of crystals followed by gamma-ray spectrometry and automatic resolution of the spectral data established the presence of iridium in all crystals. This was attributed to impurity dissolutions from the platimum crucible into the solvent with subsequent incorporation in the crystal. Sodium was produced by fast neutron reactions on the matrix. The positive erbium-3 ion was incorporated into the crystal lattice to a small extent while the larger positive neodymium 3 ion was rejected. G.G.

N70-15299# Instituto de Asuntos Nucleares, Bogota (Colombia).
DETERMINATION OF TRACES OF SELENIUM AND TELLURIUM IN SULPHUR BY NEUTRON ACTIVATION
A. Arroyo A. and J. Toro G. *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 541–543 refs (See N70-15226 04-06)
Avail: SOD $8.50

Traces of selenium and tellurium in sulphur were determined by activating samples with thermal neutrons and subsequent gamma-ray counts in a channel pulse analizer coupled to a NaI(Tl) detector. Quantitative results were obtained by comparison of photopeak areas with those of standards. A detection sensitivity of 0.07 micrograms of selenium and tellurium in the presence of sulfur was obtained. G.G.

N70-15300# Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Departamento Aplicacion.
NONDESTRUCTIVE ACTIVATION ANALYSIS FOR ARSENIC AND ANTIMONY IN SOFT SOLDERING ALLOYS
M. D. Rudelli, H. C. Rocca, and G. B. Baro *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 544–550 refs (See N70-15226 04-06)
Avail: SOD $8.50

Activation analysis of antimony in pure tin or in a high tin matrix requires the use of lithium-drifted germanium detectors to resolve photopeak interference from As-76 as well as other possible trace elements. Their high resolution makes it possible to distinguish gamma-rays differing in energy as little as 2 to 4 keV in complex gamma-ray spectra and to determine their absolute energy to better than 0.5 keV. Results of a number of analyses for concentration of antimony and arsenic are summarized. G.G.

N70-15301# Academy of Sciences (USSR), Leningrad.
THE APPLICATION OF THE ACTIVATION ANALYSIS TO THE INVESTIGATION OF SORPTION AND SUBLIMINATION PROPERTIES OF HIGH-TEMPERATURE MATERIALS
I. A. Maslov, V. A. Lucknitsky, N. M. Karnauckova, and G. I. Karajanova *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, vol. 1 Jun. 1969 p 551–562 refs (See N70-15226 04-06)
Avail: SOD $8.50

Neutron activation analysis was used to determine cesium vapor absorption by electroinsulating ceramics and to measure the evaporation rate of molybdenum and zirconium carbide in vacuum. Average values of the removed ceramic layer thickness and the corresponding cesium concentration show that cesium absorption occured mainly by chemical reactions resulting in the formation of a layer with approximately homogeneous distribution of the diffusing component. Cesium penetration depth estimates obtained from activation analysis and metallographically determined zone width, in which grain distribution due to the cesium reaction is visible, showed good agreement. Evaporation rate measurements were made by irradiation of the etched lead surface collector and its condensate with subsequent chemical isolation of the activated radionuclides and gamma-ray spectrometric determination. G.G.

N70-15302# Union Carbide Nuclear Co., Tuxedo, N.Y. Sterling Forest Research Center.
DIVERSIFIED INSTRUMENTAL NUCLEAR ANALYSIS METHODS USING A REACTOR
H. W. Nass *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 563–573 refs (See N70-15226 04-06)
Avail: SOD $8.50

The most satisfying nuclear analyses are those that are rapid and nondestructive. The intent of this paper is to briefly summarize several of the unique instrumental nuclear analysis methods that are readily adaptable to a reactor facility but are often overlooked. These methods include the use of cadmium-covered irradiations to suppress the production of interfering radionuclides, the determination of deuterium by the photoneutron method, the determination of the uranium by the delayed neutron method, and the use of solid state detectors to resolve short-lived radionuclides of interest in the presence of other radionuclides of similar gamma-ray emissions. Author

N70-15303# Palermo Univ. (Italy).
MAJOR CONSTITUENTS DETERMINATION IN SUBSTANCES BY ACTIVATION ANALYSIS
Carmelo Cappadona *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 574–576 refs (See N70-15226 04-06)
Avail: SOD $8.50

A combined technique of neutron activation and isotope dilution was used to determine macrocomponents of a substance after irradiation and dissolution with a suitable reagent. Qualitative separation of the macroelement desired is carried out in an aloquot of the solution. A known amount of isotopic carrier is added to the remaining solution, the macroconstituent is separated, and its specific activity is measured by gamma-ray spectrometry. Results from quantitative analyses on alloys such as Au, Sn, P, and Cu showed an error of less than 1 percent; best precision was attained by calculating the average of several counting measures. G.G.

N70-15304# European Atomic Energy Community, Ispra (Italy). Chemistry Dept.
RADIOCHEMICAL SEPARATIONS FOR ACTIVATION ANALYSIS
F. Girardi *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 577–616 refs (See N70-15226 04-06)
Avail: SOD $8.50

Described are radiochemical separation results obtained with organic absorbers, hydrated antimony pentoxide, acid aluminum oxide, manganese dioxide, stannic oxide, cupric sulfide, cuprous chloride, and ion exchange resins. Successive group chemical separations can be selected by analyzing gamma-ray spectra and by reducing them to a minimum for detection of low level activities. Proposed is the use of computers to make a scheme of chemical separations from known behavioral properties of the elements. G.G.

N70-15305# Florida Univ., Gainesville. Dept. of Chemistry.
GAS CHROMATOGRAPHIC SEPARATIONS IN NEUTRON ACTIVATION ANALYSIS
Stuart P. Cram and Fredrick T. Varcoe *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 620–623 refs (See N70-15226 04-06)
Avail: SOD $8.50

Described is the gas chromatographic separation of several transition metals as volatile chromium and copper chelates. Several gas phase counting systems were used for pulse-height analyses of the chromatographic effluents and a combination gas chromatography and neutron activation analysis was used for organic functional group analysis, the determination of molecular structure, and elemental analysis. G.G.

N70-15306# Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.
RAPID GROUP SEPARATION METHOD FOR NEUTRON ACTIVATION ANALYSIS OF GEOLOGICAL MATERIALS
S. F. Peterson, A. Travesi, and G. H. Morrison *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 624–633 refs Sponsored by ARPA (See N70-15226 04-06)
Avail: SOD $8.50

High resolution lithium-drifted germanium gamma-ray detectors were used in nondestructive activation analysis of 29 elements in rocks. Chemical separation was performed with hydrated antimony pentoxide, ion exchange resin, tri-n-butyl phosphate extraction in five groups, and gamma-ray spectroscopy using Ge(Li) detectors. Except for Na, K, and Fe all elements were at the part per million level. G.G.

N70-15307# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
GROUP RADIOCHEMICAL SEPARATIONS: A PRACTICAL APPROACH TO ACTIVATION ANALYSIS
Barbara A. Thompson *In its* Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 634–638 refs (See N70-15226 04-06)
Avail: SOD $8.50

Group separations were studied and guidelines for choosing the proper group separation procedure are given. Activation analysis of high purity zinc and minor constituents in steel and cast iron were performed and the use of Ge(Li) gamma-ray spectroscopy on those two samples gave a reduction of the number of chemical groups. Choice of technique rests on the nature of the matrix and on the information desired. Ion exchange methods usually obtain rapid separations; however, chemical solvent extraction or precipitation methods are sometimes indicated. G.G.

N70-15308# European Atomic Energy Community, Ispra (Italy). Chemistry Dept.
RADIOCHEMICAL SEPARATIONS BY RETENTION IN INORGANIC PRECIPITATES
F. Girardi, R. Pietra, and E. Sabbioni *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, vol. 1 Jun. 1969 p 639–641 refs (See N70-15226 04-06)
Avail: SOD $8.50

The behavior of ions in a variety of materials and from different media was surveyed experimentally to search for simpler ways of making radiochemical separations; to see whether data correlation on the behavior of different materials was possible; and to provide starting data for computer aided radiochemistry. The material--medium couples studied are tabulated. The results of each run were schematically reported by classifying the behavior of the element into one of three groups: element completely retained, element completely eluted, and element partially retained. Preliminary results indicate: (1) Of the nine oxides examined, HMD, HAP, and SnO_2 give a variety of useful applications. (2) The affinity of Al_2O_3 for phosphates is coupled to a sufficiently high selectivity to make this material interesting for the reduction of bremsstrahlung from gamma spectra of biological specimens. (3) The three phosphates of Zr, Ti, and Sn have good exchange properties at high ionic strength. (4) Copper sulfide can be used successfully for separating copper by isotopic exchange. M.G.J.

N70-15309# Pavia Univ. (Italy).
CHROMIUM SEPARATION BY INORGANIC EXCHANGERS IN ACTIVATION ANALYSIS OF BIOLOGICAL MATERIALS
Sandro Meloni, Alberto Brandone, and Vera Maxia *In* Natl. Bur. of Std. Mod. Trends in Activation Vol. 1 Jun. 1969 p 642–645 refs (See N70-15226 04-06)
Avail: SOD $8.50

A neutron activation method for chromium analysis is proposed, based on carrier free chemical separations which are performed in a relatively short time. The biological material consisted of human blood serum and red cells. Aliquots of each were pipetted in quartz

vials and dried in an oven at 50 to 60 deg C. The vials were then sealed and put in the irradiation container together with a chromium standard in the form of ammonium chromate solution. The irradiation was carried out for 30 hours in the rotatory specimen rack of the reactor. After a cooling time of about two days, the quartz vials are broken and the blood mineralized with concentrated nitric acid and hydrogen peroxide. For the chromium separation, three inorganic adsorbers were used in cascade: hydrated antimony pentoxide (HAP), tin dioxide, and manganese dioxide. By comparing the net 0.32 MeV photopeak areas of manganese dioxide disk and chromium standard spectra, the chromium content is obtained. The method is said to be highly reproducible and the precision of results is about 4%. M.G.J.

N70-15310# Commissariat a l'Energie Atomique, Saclay (France). Nuclear Research Centre.

QUANTITATIVE DETERMINATION OF IMPURITIES IN NUCLEAR GRAPHITES BY RADIOACTIVATION METHODS

S. May and G. Pinte *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 655–665 refs (See N70-15226 04-06)

Avail: SOD $8.50

A method of systematic analysis was developed, which makes it possible to determine about 20 impurities in one sample. The elements found are silver, selenium, mercury, antimony, copper, iron, gallium, cobalt, cadmium, zinc, indium, zirconium, chromium, scandium, barium, calcium, sodium, potassium, rubidium, and cesium. Mentioned briefly are the methods used for determination of all the rare earths, silicon, sulfur, and phosphorus, as well as the elements which can be determined without chemical separation: chlorine, manganese, and vanadium. Author

N70-15311# Centre National de la Recherche Scientifique, Vitry (France).

DETERMINATION OF THE DISTRIBUTION COEFFICIENTS OF THE ELEMENTS OF THE IB, VB, VIA AND VIB GROUPS IN ANIONIC ION EXCHANGE RESIN IN THE WATER-HYDROCHLORIC ACID-ACETONE MIXTURE

Ch. Cleyrergue, N. Deschamps, and Ph. Albert *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 646–654 refs (See N70-15226 04-06)

Avail: SOD $8.50

The variation of the distribution coefficient as a function of the percent acetone in a 0.5 N HCl solution was studied for the following elements: As, Sb, Au, Ag, Cu, Se, Te, Mo, and W. The static method was employed, whereby a known quantity of resin is put in contact with a solution containing a known quantity of the dissolved element. The resin is stirred until equilibrium is reached, and the element is titrated in both phases. In the experiments, radioisotopes of the elements were used; this permitted an easy measurement of the concentration of the elements on both the resin and the solution. The measurements were performed by gamma spectrometry with an NaI(Tl) crystal and a multichannel pulse height analyzer. Figures depicting the variations are included. M.G.J.

N70-15312# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.

RADIOCHEMICAL SEPARATIONS FOR ACTIVATION ANALYSIS USING BIS(2-ETHYL-HEXYL) ORTHOPHOSPHORIC ACID

I. H. Qureshi, L. T. Mc Clendon, and P. D. La Fleur *In its* Mod. Trends in Activation Analysis, Vol. 1 Jun. 1969 p 666–671 refs (See N70-15226 04-06)

Avail: SOD $8.50

Experiments were conducted to study the extraction of metal ions into bis(2-ethyl-hexyl) orthophosphoric acid (HDEHP) from 1 M to 11 M nitric, hydrochloric, and perchloric acids. The extractions were performed in centrifuge tubes containing 9.9 ml of the acid and 0.1 ml of the tracer element. A mechanical shaker was used to mix the phases during extraction, and a scintillation counter having an automatic sample changer was used for the radioassay of the samples. Figures depict the percent extraction of the metals into HDEHP as a function of acid concentration. Preliminary results indicate that both nitric and perchloric acids participate in the extraction at concentration greater than 5 M, which corresponds quite closely to the point where enhanced extraction is noted. It was concluded that bis(2-ethyl-hexyl) phosphoric is a useful extractant, and appears to hold excellent promise for group chemical separations. M.G.J.

N70-15313# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.

MODERN TRENDS IN ACTIVATION ANALYSIS, VOLUME 2

James R. De Voe and Philip D. La Fleur, eds. Jun. 1969 674 p refs Held at Gaithersburg, Md. 7-11 Oct. 1968 Sponsored jointly with AEC, IAEC, and EURISTOP

(NBS-Spec-Publ-312-Vol-2) Avail: SOD $8.50

Conference papers are presented on nuclear reactions in activation analysis, radiation detectors, data handling and processing, computation methods, error analysis, and information retrieval. For individual titles see N70-15313 through N70-15386.

N70-15317# Centre d'Etudes de Chimie Metallurgique, Vitry (France).

CONTRIBUTION TO ACTIVATION ANALYSIS BY CHARGED PARTICLES: DETERMINATION OF CARBON AND OXYGEN IN PURE METALS, POSSIBILITIES OF SULPHUR DETERMINATION

Jean-Luc Debrun, Jean-Noel Barrandon, and Ph. Albert *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 774–784 refs (See N70-15313 04-06)

Avail: SOD $8.50

The results of are presented of the determination of oxygen in high purity iron, nickel, and chromium samples by He-3 and He-4 irradiation. The interference of fluorine was studied up to 30 MeV with He-3 and 55 MeV with He-4. The possibility of carbon determination by means of C-11 induced by nuclear reaction on carbon by He-3 and He-4 is studied. Interferences by beryllium and oxygen were experimentally measured up to 30 MeV with He-3 and 55 MeV with He-4. It is shown that sensitive determination of sulphur can be performed by irradiation with the usual charged particles which lead to Cl-34m. The He isotopes give almost the same results as the fast neutrons; interferences cannot be limited and are rather important. Dueterons are more interesting because phosphorous interference does not exist. Protons and tritons present exceptional interest because they allow the determination of sulphur without interference with all the advantages of activation analysis. Author

N70-15319# Naval Research Lab., Washington, D.C. Nuclear Physics Div.

SURFACE ANALYSIS OF GOLD AND PLATINUM DISKS BY ACTIVATION METHODS AND BY PROMPT RADIATION FROM NUCLEAR REACTIONS

James W. Butler and Eligius A. Wolicki *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 791–793 ref (See N70-15313 04-06)

Avail: SOD $8.50

Methods are reported for testing the surfaces of gold and platinum for carbon, oxygen, and aluminum contamination. Carbon and oxygen were detected through the C-11 and F-18 positron emitters produced by the C-12(He-3, alpha) C-11 and O-16(Hw-3,p)F-18 reactions, respectively. Aluminum contamination was measured by means of the prompt gamma radiation from the Al-27(p,gamma)Si-28 reaction. Author

N70-15320# Centre d'Etudes de Chimie Metallurgique, Vitry (France).
DETERMINATION OF OXYGEN PRESENT AT THE SURFACE OF METALS BY IRRADIATION WITH 2 MeV TRITONS
J.-N. Barrandon and Ph. Albert *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 794–801 refs (See N70-15313 04-06)
Avail: SOD $8.50

Experiments performed for surface oxygen determination by means of radioactivation analysis are described. The excitation function of the reaction O-16(He-3,n)F-18 was experimentally plotted for 0.5 to 3 MeV. The 2 MeV tritons accelerated in a Van de Graaff offer good conditions for the determination of surface oxygen. It was determined that no chemical separation is necessary when the method is applied to aluminum, iron, chromium, nickel, and zirconium. The method permits surface oxygen measurements in the range of 100 to .001 microgram/sq cm. Author

N70-15322# Lyon Univ. (France).
CROSS SECTIONS OF F-18 FORMATION BY DEUTERON BOMBARDMENT OF OXYGEN AND FLUORINE APPLICATIONS TO OXYGEN ANALYSIS
Minh Duc Tran, A. Chenaud, H. Giron, and J. Tousset *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 811–818 refs (See N70-15313 04-06)
Avail: SOD $8.50

The determination of excitation functions in relative units was carried by counting stacks of oxygen compounds in thin disks in which the stopping power is known. The importance of spallation reactions producing F-18 was estimated. A comparison of oxygen and fluorine analyses permitted the determination of the reciprocal interference and its variation versus the deuteron energy. A comparison of oxygen analysis by F-18 formation obtained with deuteron and alpha reactions specified the choice of particle according to the energy. Author

N70-15323# Commissariat a l'Energie Atomique, Saclay (France). Departmente de Metallurgie.
EXAMPLES OF DETERMINATION OF LIGHT ELEMENTS IN VARIOUS HIGH PURITY MATERIALS, BY GAMMA PHOTON AND CHARGED PARTICLE ACTIVATION
Charles Engelmann, James Gosset, Monique Loeuillet, Alain Marschal, Pierre Ossart et al *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 819–828 refs (See N70-15313 04-06)
Avail: SOD $8.50

Results obtained over the last few years are presented, and the method of preparing the sample by irradiation and etching is described. Nondestructive determination of oxygen was accomplished in silicon by 42 MeV alpha and 15 MeV proton activation, and in iron and niobium by 14.7 MeV He-3. Oxygen was also determined by a 35 MeV photon beam activation followed by a chemical separation of O-15 by reducing fusion. The simultaneous separation of N-13 and C-11 was performed after gamma irradiation and etching. The results showed that low concentrations of light elements can be determined by gamma photon and charged particle activation. The lowest amounts determinable are .01 for gamma activation and .0001 for charged particle activation. N.E.N.

N70-15325# Atomic Energy of Canada, Ltd., Ottawa (Ontario).
PHOTON ACTIVATION ANALYSIS OF OXYGEN AND CARBON IN A EUTECTIC MIXTURE OF LEAD AND BISMUTH USING A LINAC
W. D. Mackintosh and R. E. Jervis Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 835–837 refs Prepared in cooperation with Toronto Univ. (See N70-15313 04-06)
Avail: SOD $8.50

The method of high energy bremsstrahlung beams was applied to trace analysis in an eutectic mixture proposed as a spallation target for an intense neutron generator. Preliminary experiments indicated that a 1 g sample of the eutectic was most suitable and that zirconia and Mylar foil were the best standards for oxygen and carbon respectively. The oxygen and carbon were determined with sensitivities of 3 and 5 ppm respectively. N.E.N.

N70-15326# Centre d'Etudes de Chimie Metallurgique, Vitry (France).
DETERMINATION OF CARBON IN HIGH PURITY IRON BY IRRADIATION IN PHOTONS
G. Revel, Th. Chaudron, J. L. De Brun, and Ph. Albert *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 838–841 refs (See N70-15313 04-06)
Avail: SOD $8.50

The experimental procedures of using photon activation analysis for low concentration carbon determination are briefly described. The reaction C-12(gamma,n)C-11 was used and thin graphite sheets served as standards. After irradiation the sample was etched in acid solutions, carbon was extracted by combustion, and the carbon dioxide was absorbed in soda asbestos. The advantages of activation analysis are considered to be that etching prevents surface pollutions, carbon released by walls and crucible does not introduce error, and losses by adsorption are considerably diminished. N.E.N.

N70-15327# Institute of Physical and Chemical Research, Saitama (Japan).
CHARGED PARTICLE ACTIVATION ANALYSIS FOR CARBON, NITROGEN, AND OXYGEN IN SEMICONDUCTOR SILICON
Tadashi Nozaki, Yoshifumi Yatsurugi, Nobuyuki Akiyama and Itaru Imai *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 842–846 refs Prepared in cooperation with Komatsu Electronic Metals Co. (See N70-15313 04-06)
Avail: SOD $8.50

The analytic procedures for quantitative determinations are described. The reactions adopted for carbon and nitrogen are C-12(He-3,alpha)C-11 and N-14(p,alpha)C-11, respectively, and for oxygen are O-16(He-3,p)F-18 and O-16(He-3,n)Ne-18 yields F-18. The interference reactions are also identified and discussed, and a convenient technique for separating C-11 is described. As low as 10 ppb of contaminants were determined. Carbon content was found to vary according to production methods; nitrogen content was less than 20 ppb; and oxygen content was observed to vary widely. N.E.N.

N70-15333# National Bureau of Standards, Washington, D.C.
BLANK CONSIDERATIONS IN 14 MeV NEUTRON ACTIVATION ANALYSIS FOR TRACE OXYGEN
S. S. Nargolwalla, E. P. Przybylowicz, J. E. Suddueth, and S. L. Birkhead *In its* Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 879–887 refs (See N70-15313 04-06)
Avail: SOD $8.50

A technique is described which provides a generalized solution to the problem of oxygen contribution from the blank. The attenuation of the activity from the container was determined by samples of different diameters. A geometrical model which quantitatively expresses the observed attenuation by samples was defined. The flow through polyethylene container perforated by 5/16 in. diameter holes reduces the capsule blank contribution and eliminates the need to encapsulate samples in a nitrogen atmosphere. Author

N70-15334# National Bureau of Standards, Washington, D.C.
ACTIVATION ANALYSIS OF CHLORIDE AND IODIDE IN PHOTOGRAPHIC EMULSIONS USING 14.7 AND 2.8 MeV NEUTRONS

E. P. Przybylowicz, Golbert W. Smith, J. E. Suddueth, and S. S. Nargolwalla *In its* Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 888–894 refs (See N70-15313 04-06)
Avail: SOD $8.50

The potentialities of a nondestructive neutron activation technique are examined for determining the composition of the silver halide component of photographic emulsion. Emphasis was on the development of calibration data for the measurement of iodide in silver iodide--silver bromide emulsions, and chloride in silver chloride--silver bromide emulsions. Calibration curves are presented for chlorine and iodine, and neutron attenuation and gamma ray self absorption effects are considered. It is concluded that the technique provides rapid analysis with reasonably good precision and accuracy. N.E.N.

N70-15338# Texas Nuclear Corp., Austin.
ON-STREAM ACTIVATION ANALYSIS USING SAMPLE RECIRCULATION
J. B. Ashe, P. F. Berry , and J. R. Rhodes *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 913–917 refs (See N70-15313 04-06)
Avail: SOD $8.50

Mathematical expressions are presented for the count and flow characteristics in the recirculation loop. An experiment using an aqueous slurry of taconite ore was performed, and calculated and experimental gain factors were found to be in good agreement. N.E.N.

N70-15344# Southern Univ. Nuclear Inst., Faure (South Africa).
SURFACE ANALYSIS OF MEDIUM WEIGHT ELEMENTS BY PROMPT CHARGED PARTICLE SPECTROMETRY
Colenso Olivier and Max Peisach *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 946–952 refs (See N70-15313 04-06)
Avail: SOD $8.50

The method using prompt protons from (d,p) reactions was evaluated for the determination of nickel films on copper and chromium films on nickel. Standard thicknesses of nickel on copper and tantalum, of copper on tantalum and of chromium on nickel and tantalum were prepared by electroplating and weighing. Surface film thicknesses ranging from 10 to 5000 microgram/sq cm were used. These targets were irradiated in a 75-cm scattering chamber with a current of 0.5 to 1 microampere of deuterons of 3.5 MeV. Author

N70-15356# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
COMPUTERIZED QUANTITATIVE ANALYSIS OF HIGH-RESOLUTION SPECTRA
John A. Dooley, James H. Gorrell, Paul Polishuk, and Myron Young *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1090–1096 refs Prepared in cooperation with La. State Univ. (See N70-15313 04-06)
Avail: SOD $8.50

In neutron activation analysis there is a requirement for an initial quick look followed by more detailed analysis. A computer program is essential for the data reduction of the high resolution spectral detail. The Spectral Peak Search and Analysis Computational System (SPSA) was constructed especially to satisfy the requirements of flexible and convenient input for 4096 channels, location and analysis of peaks, automatic energy calibration, and formatted output including on-line plotted and printed data and analysis. SPSA places no special requirement on the experimenter with regard to his choice of amplifier gains, detection geometry or other set-up conditions. The FORTRAN 4 system will fit into 32K core storage and only the tape control section is peculiar to the direct-coupled IBM 7094, for which SPSA was designed. Author

N70-15356*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON-LINE DATA ANALYSIS OF DIGITAL PULSE-HEIGHT SPECTRA. PART 1: ANALYTICAL STRUCTURE. PART 2: OPERATIONAL COMPUTER SYSTEMS
J. I. Trombka and R. L. Schmadebeck *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1097–1101 refs (See N70-15313 04-06)
Avail: SOD $8.50

Data processing techniques and computer system components are specified for on-line processing of geochemical digital spectra data. The least squares analysis program is run on a CDC 3200 computer. E.C.

N70-15357# Battelle-Northwest, Richland, Wash.
SPECTRAL DATA HANDLING SYSTEMS
F. P. Brauer and J. E. Schlosser *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1102–1107 refs (See N70-15313 04-06)
(Contract AT(45-1)-1830)
Avail: SOD $8.50

Data processing systems utilizing large digital computing center facilities have been developed for the assembly of spectra files, analysis of the spectra, and storage and retrieval of the analytical results. Author

N70-15358# Texas A&M Univ., College Station. Activation Analysis Research Lab.
HEVESY: A COMPUTER PROGRAM FOR ANALYSIS OF ACTIVATION ANALYSIS GAMMA-RAY SPECTRA
Herbert P. Yule *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1108–1110 refs (See N70-15313 04-06)
Avail: SOD $8.50

A general purpose activation analysis computer program is briefly described. Program advantages include: (1) fast and accurate peak location by the derivative sign change method, without input information on approximate location, (2) extraction of correct information from data sets containing invalid information, and (3) automatic concentration calculation, freeing the analyst from punching cards for half lives, peak locations, and peak boundary locations. E.C.

N70-15359# European Atomic Energy Community, Ispra (Italy).
DEVELOPMENT OF A DIRECT CONNECTION BETWEEN AN ACTIVATION ANALYSIS LABORATORY AND AN IBM 360/65 COMPUTER
F. Girardi, G. Guzzi, G. Di Cola, W. Becker, and A. Termanini *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1111–1115 (See N70-15313 04-06)
Avail: SOD $8.50

A teleprocessing system between the activation analysis laboratory and an IBM 360/65 is described. The installation is basically composed of an IBM 1070 telecommunication system installed in the counting room and connected by a coaxial cable to the main computer. An interface, a digital entry device, and an electronic clock complete the system. Author

N70-15360# United Kingdom Atomic Energy Authority, Harwell (England). Analytical Sciences Div.
DEVELOPMENTS IN THE USE OF SMALL DIGITAL COMPUTERS IN ACTIVATION ANALYSIS SYSTEMS
T. B. Pierce, R. K. Webster, R. Hallett, and D. Mapper *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1116–1120 ref (See N70-15313 04-06)
Avail: SOD $8.50

The uses to which a small computer has been applied

for activation analysis are described. Experience has so far been gained in using a PDP-8 computer as a gamma spectrometer, and for processing data for neutron and charged particle activation. Author

N70-15361# Atomic Energy of Canada, Ltd., Ottawa (Ontario). Commercial Products.

ON-LINE ACTIVATION ANALYSIS WITH A PDP-9 COMPUTER

C. J. Thompson *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1121–1126 refs (See N70-15313 04-06)

Avail: SOD $8.50

The basic elements of the activation analysis system are: (1) an antimony beryllium thermal neutron source with a flux of up to 7 × 10 to the 8th power n/sq cm/sec, (2) a PDP-9 computer which is used to acquire and analyze the spectra, and (3) a fast pneumatic sample changing system. The system has been designed for routine quantitative measurements of a few elements in many samples on a continuous basis, and for rapidly analyzing complex spectra to find the elements present in unknown samples. Author

N70-15366# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

CATALOGUE OF GAMMA RAYS EMITTED BY RADIONUCLIDES

M. A. Wakat *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1144–1147 refs (See N70-15313 04-06)

(Contract AT(07-2)-1)

Avail: SOD $8.50

A catalogue that includes measured gamma rays emitted by radioactive nuclei and information provided by Ge(Li) spectroscopy is being compiled. This compilation will be useful to those laboratories developing computer programs for data reduction of Ge(Li) spectra by providing library information for comparisons. Author

N70-15367# Air Force Systems Command, Wright-Patterson AFB, Ohio.

COMPUTERIZED IDENTIFICATION OF REACTOR-PRODUCED ISOTOPES

John A. Dooley, James H. Gorrell, James Thompson, and Edward Hoffman *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1148–1153 refs Prepared in cooperation with Dayton Univ. (See N70-15313 04-06)

Avail: SOD $8.50

When analyzing unknown samples using reactor activation analysis, the problem frequently arose as to what major and contaminant constituents were in the samples. It was necessary to answer this question before quantitative determinations could be made. To aid in this type of qualitative identification, a Fortran-IV computational system was developed which uses the photopeak energies found in an unknown spectrum and logically determines which isotopes are present. The photopeak energies from a spectrum are compared to an energy-isotope list. Isotopes which could have emitted each gamma ray present in the sample spectrum are tabulated. Isotopes which emit gamma rays not present in the spectrum are rejected. Output includes lists of varying certainty of identification, including annihilation, sum and escape peaks. Accuracy and speed of analysis are controlled by the detection system resolution and compatible energy calibration. Thus, there is considerable advantage in using a high resolution detector system to obtain the spectrum. System operation and results are illustrated using a composite spectrum of five isotopes. Author

N70-15368# Texas A&M Univ., College Station. Activation Analysis Research Lab.

COMPUTATION OF EXPERIMENTAL RESULTS IN ACTIVATION ANALYSIS

Herbert P. Yule *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1155–1204 refs (See N70-15313 04-06)

Avail: SOD $8.50

Preliminary considerations that affect the method for computing results and the degree of effort required to produce an accurate result are treated, followed by a brief outline of the history of activation analysis up to 1962. A detailed description of current computational techniques is then given. Where possible, an indication is made of the contributions of various researchers toward improved accuracy. Current techniques discussed are: (1) computation of net peak areas; (2) least squares analysis of pulse height spectra; (3) spectrum stripping and smoothing ; and (4) decay curve analysis. A critical evaluation of each of the above methods is also included, with comments on accuracy of the computed results, specific errors identified, and incidents of complete failure of the method. Finally, some speculations are made on future directions and anticipated improvements in activation analysis instrumentation and methodology. A.C.R.

N70-15369# Argonne National Lab., Ill. Radiological Physics Div.

COMPUTER ANALYSIS OF GAMMA-RAY SPECTRA: VALIDITY OF THE RESULTS

Henry F. Lucas, Jr. and David N. Edgington *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1207–1214 refs Sponsored by AEC (See N70-15313 04-06)

Avail: SOD $8.50

A brief discussion is presented of the validity of input data and results obtained from gamma ray spectrum analysis, performed by an iterative, weighted linear least squares program, on a CDC 3600 computer. Particular problems associated with this type of computation are highlighted; these include non-random instrumental effects, such as channel dropout and pulse pileup. A.C.R.

N70-15370# National Bureau of Standards, Washington, D.C.

THE DISCOVERY OF ERRORS IN THE DETECTION OF TRACE COMPONENTS IN GAMMA SPECTRAL ANALYSIS

Lloyd A. Currie *In its* Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1215–1219 refs (See N70-15313 04-06)

Avail: SOD $8.50

Detection limits in overdetermined systems for estimating individual radionuclide contributions to an observed composite gamma spectrum are discussed, and it is demonstrated by an iterative, least squares calculation that the detection limit is dependent upon the levels of interfering components and the magnitude of the correlation coefficient. Model errors arising when one or more of the components in a mixutre lies below its detection limit, are also mentioned. It is concluded that when dealing with trace analysis, extreme caution must be exercised to avoid using an oversimplified model, since systematic errors may be great, while popular fit-statistics may appear satisfactory. Author

N70-15372# NUS Corp., Washington, D.C.

COMPUTER GAIN CHANGING OF SCINTILLATION SPECTRA

J. J. Steyn and D. G. Andrews *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1231–1237 refs Prepared in cooperation with Toronto Univ. (See N70-15313 04-06)

Avail: SOD $8.50

A gain changing code, GANE, is described that was developed to aid in computer spectrum analysis during research in gamma photon backscattering. It is based on a gain decreasing algorithm for numerical redistribution of a histogram spectrum, and extensive testing verified its accuracy and time-saving capabilities, in addition to indicating a variety of applications. Author

N70-15373# California Univ., Livermore. Lawrence Radiation Lab.
A COMPUTER METHOD OF PEAK AREA DETERMINATIONS FROM Ge(Li) GAMMA SPECTRA
H. Robert Ralston and George E. Wilcox *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1238–1243 Sponsored by AEC (See N70-15313 04-06)
Avail: SOD $8.50

A program for defining the baseline and limits from which to begin and end the integration of a peak area is described and its accuracy evaluated. A quantitative analysis of the program was obtained using a pulser. The pulse was injected into the preamplifier at the point at which the Ge(Li) diode signal appears, yielding a resolution about 0.5 keV better than that measured with diode pulses. Author

N70-15374# California Univ., Livermore. Lawrence Radiation Lab.
QUANTITATIVE ANALYSIS OF UNKNOWN MIXTURES BY COMPUTER REDUCTION OF Ge(Li) SPECTRA
Ray Gunnink and J. B. Niday *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1244–1245 refs Sponsored by AEC (See N70-15313 04-06)
Avail: SOD $8.50

A modified computer code is briefly described which is capable of accurate reduction and interpretation of spectral data obtained from a gamma ray detector system used in nondestructive analyses. The major change involved treatment of unresolved peak interferences in the final computation of the disintegration rates of the various components. Author

N70-15375# Shell Development Co., Emeryville, Calif.
A COMPUTER-BASED SYSTEM FOR NEUTRON ACTIVATION ANALYSIS
D. D. Tunnicliff and G. E. A. Wyld *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1246–1249 refs (See N70-15313 04-06)
Avail: SOD $8.50

The application of stepwise regression methods to processing data from neutron activation analyses is briefly discussed. The program makes simultaneous use of spectral data for as many as six decay times, a procedure which greatly increases the power of the method. The procedure for setting up the matrix arrays for calculation, some of the problems encountered, and results of typical analyses are highlighted. Author

N70-15377# Texas A&M Univ., College Station. Activation Analysis Research Lab.
COMPUTER STUDIES OF COMPLEX FULL ENERGY PEAKS USING SECOND AND THIRD DERIVATIVES
Herbert P. Yule *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1256–1259 refs (See N70-15313 04-06)
Avail: SOD $8.50

Adaptation of the simplified, least-squares data convolution technique to studies of complex Ge(Li) detector peaks with smoothed second and third derivatives is reported. Complex spectra were generated in the laboratory by counting a Cr-51 source at various settings of the slope/intercept potentiometer, which translates the energy axis without changing channel widths. It was therefore possible to move the Cr-51 peak from its usual position, centered around channel 321, to another channel. Complex peaks were formed by accumulating a peak, changing the potentiometer, and, without erasing the first spectrum, taking another count. By varying counting periods, it was possible to mix peaks of different sizes. A number of questions still remain concerning the application of this method to complex peak detection and are presently being studied. Author

N70-15378# Atomic Weapons Research Establishment, Aldermaston (England).
THE PRECISION OF MULTI-ELEMENT TECHNIQUES IN ACTIVATION ANALYSIS
R. F. Coleman *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1262–1267 ref (See N70-15313 04-06)
Avail: SOD $8.50

The analytical precision of known mixtures was determined by three activation methods, as well as by a more practical test involving analysis of a glass sample with more than 20 detectable components. Activation analysis of the artificial mixtures demonstrated that the precision varies depending on the contribution of the particular nuclide to the total activity. The measurement method showing the best precision utilized a sodium iodide crystal and a least-squares spectrum analysis technique. Analysis of trace element detection in glass indicated that for the majority of elements the mean values are in reasonable agreement; the group separation method showed the best precision, while measurement by germanium detectors yielded poor results. A.C.R.

N70-15379# Pinchiney Compagnie de Produits Chimiques et Electrometallurgiques, Paris (France). Centre de Recherches.
CONTRIBUTION TO IMPROVEMENTS IN ACCURACY AND REPRODUCIBILITY OF ROUTINE ACTIVATION ANALYSIS
F. Dugain *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1268–1278 refs (See N70-15313 04-06)
Avail: SOD $8.50

Attempts to obtain the maximum certitude about the value of each standard used in routine analyses and to estimate the flux depression, as well as a practical approach to compensate for its effect, are described. Irradiations were made in a pool reactor, and radiochemical separations were carried out on anion exchange resins. The arrangement of standards in the irradiation can is indicated; the distribution of 180 standards after counting the activity of the Na-22 additive is plotted, showing a precision on each value of + or — 0.6%; the effect of flux depression in a pool reactor is indicated for five samples; and the maximum flux depression according to the relative position in the can is shown. Finally, some examples are given which seem to confirm conclusions concerning either accuracy or reproducibility of the analyses. Author

N70-15380# McMaster Univ., Hamilton (Ontario). Dept. of Chemistry.
PRECISION IN THE NEUTRON ACTIVATION ANALYSIS FOR GOLD IN STANDARD ROCKS G-1 AND W-1
K. Fritze and R. Robertson *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1279–1283 refs (See N70-15313 04-06)
Avail: SOD $8.50

Tabulation of gold concentration in standard rocks, G-1 and W-1, as determined by a number of analysts showed considerable discrepancies between the two samples. Despite the fact that there are specific difficulties in activation analysis for gold, related to the preparation of standards and to the exchange between carrier and radioactive gold, it appeared that these sources of error cannot account for such large discrepancies. Since these data variations appeared to be due in part to the samples themselves, further investigations to determine whether or not gold is homogeneously distributed in G-1 and W-1 were performed. Results indicate that the trace quantities of gold in the two samples are not distributed in this manner, with the effect being much stronger for G-1. An explanation for this heterogeneity of trace element distribution is also proposed. A.C.R.

N70-15381# Ford Motor Co., Dearborn, Mich.
HIGH PRECISION ACTIVATION ANALYSIS OF SODIUM USING AN INTERNAL STANDARD TECHNIQUE

R. H. Marsh and W. Allie, Jr. *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1284–1290 refs (See N70-15313 04-06)
Avail: SOD $8.50

Internal standard techniques for high-precision analysis of sodium are desirable, since they obviate the necessity of mapping reactor neutron flux and of maintaining strictly uniform counting geometry. The method and procedures are outlined for the experimental work, during which two major sources of error became apparent. The first error is related to difficulty in obtaining a well thermalized flux, and the second source was in subtracting out the pure sodium and arsenic background blanks. Proposed solutions to these problems are offered, including substitution of computer data reproduction and analysis procedures. In order to see if the internal standard technique could be used for trace analysis, studies of ceramic samples employing a 2048-channel analyzer with a digital spectrum stabilizer were conducted and the results tabulated. The major inaccuracies in this procedure appeared to be random counting errors and small weighing errors. Author

N70-15382# National Bureau of Standards, Washington, D.C. Office of Standard Reference Materials.
NBS STANDARD REFERENCE MATERIALS AVAILABLE FOR ACTIVATION ANALYSIS
W. Wayne Meinke and J. Paul Cali *In its* Mod. Trends in Activation Analysis, vol. 2 Jun. 1969 p 1291–1293 (See N70-15313 04-06)
Avail: SOD $8.50

Results of recent NBS investigations of several standard reference materials (SRM's), using electron microprobe analysis and residual resistivity ratio techniques, are briefly mentioned. With the former method homogeneity at a spatial resoltuion to a few microns is possible, and it appears that several NBS–SRM's now available as stock items are eminently suitable as round-robin standards for activation analysis. The second method mentioned above provides homogeneity information for *only* electrically active elements, but since these are generally the metallic elements, it can be shown that several very high purity SRM's are suitably homogeneous for many elements of interest. Author

N70-15383# National Bureau of Standards, Washington, D.C. Office of Standard Reference Materials.
THE ROLE OF ACTIVATION ANALYSIS IN THE NBS STANDARD REFERENCE MATERIAL PROGRAM
J. Paul Cali *In its* Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1294–1297 (See N70-15313 04-06)
Avail: SOD $8.50

The activation analysis technique is assessed for uniqueness, utility, advantages, and drawbacks as compared to the other procedures now available to the NBS Standard Reference Material (SRM) Program. From this study, it is concluded that past contributions of activation analysis to the SRM program have been significant, but the real test in terms of accuracy of analysis and in volume of work has not yet been completed. Over 17 SRM projects now in process are drawing heavily on this method for certifying a wide variety of elemental determinations covering the entire periodic table. A.C.R.

N70-15384# Ghent Univ. (Belgium). Inst. for Nuclear Sciences.
AN OXYGEN STANDARD FOR THE DETERMINATION OF OXYGEN IN STEEL BY 14 MeV NEUTRON ACTIVATION ANALYSIS
R. Gijbels, A. Speecke, and J. Hoste *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1298–1305 refs (See N70-15313 04-06)
Avail: SOD $8.50

For determining oxygen content in steel via the reaction O-16(n,p)N-16 by means of 14 MeV neutrons, a relative method was adopted in which the amount of oxygen in the given sample is measured by comparison with a standard of known content. Since the method was developed for industrial application, the system must be as simple and reliable as possible and the samples easy and fast to prepare from frustoconically-shaped bomb samples that are now being used in European steel plants. For this reason, a rotating sample assembly was not considered. The following characteristics of the technique as derived from performance tests are treated: (1) correction factors; (2) accuracy tests; (3) long-term reproducibility; and (4) influence of beam defocalization and distance of sample to target. A.C.R.

N70-15385# Battelle-Northwest, Richland, Wash.
A HIGH PURITY CELLULOSE AS A POSSIBLE BIOLOGICAL REFERENCE MATERIAL
L. A. Rancitelli, T. M. Tanner, and W. A. Haller *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1306–1309 refs (See N70-15313 04-06)
(Contract AT(45-1)-1830)
Avail: SOD $8.50

The properties and performance evaluation of a high purity, commercially available, cellulose filter which fulfills the criteria for a biological reference material are described. In particular, a trace element analysis by direct instrumental neutron activation was performed to demonstrate the homogeneity and purity of the material. The analytical technique that permits sufficiently precise trace element measurements at the required low concentrations is also treated. A.C.R.

N70-15386# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
MICROSTANDARDS FOR ACTIVATION ANALYSIS
David H. Freeman *In its* Mod Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1311–1316 refs (See N70-15313 04-06)
Avail: SOD $8.50

The characteristics of a single ion exchange bead that make it suitable for encapsulation of a precisely-defined quantity of matter are described, and the use of these beads as potential microstandards is evaluated. The general conclusion from experiments with neutron activation and analysis of single sodium-loaded beads is that these materials are emerging with precisely demonstrable homogeneity and are providing new capabilities for accurate microstandardization. Author

N70-15447# Japan Atomic Energy Research Inst., Ibaraki.
OSAKA LABORATORY FOR RADIATION CHEMISTRY, VOLUME 2 Annual Report, 1 Apr. 1968–31 Mar. 1969
1969 209 p refs In JAPANESE; ENGLISH summary
(JAERI-5022) Avail: CFSTI

Research activities in the following fields are presented: interaction of low energy electrons with matter, radiation-induced thermoluminescence, radiation effects on organometallic compounds, biological substances and adsorbed molecules, radiation-induced polymerization, and viscoelastic properties of graft copolymers. For individual titles, see N70-15448 through N70-15478.

N70-15448# Japan Atomic Energy Research Inst., Ibaraki.
FORMATION OF DIMER CATIONS OF TOLUENE AND p-XYLENE IN THE ADSORBED STATES
Siro Nagal, Shun-Ichi Ohnishi, and Isamu Nitta *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 1–5 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Free radicals from gamma-irradiated methylbenzene-silica gel systems were investigated by ESR from the standpoint of the extension of the study in benzene-silica gel system. Changes of ESR spectra with the amount of adsorbates were studied in detail. ESR spectra observed from toluene-silica gel and rho-xylene-silica gel systems showed the formation of the respective monomer and

dimer cation radicals. On the other hand, evidence of dimer cation formation was not obtained in o-xylene, m-xylene and mesitylene on silica gel. Isotherm of benzene-silica gel system showed an anomalous behavior in the low pressure region, and this anomaly suggests that the dimer molecule may be formed in the adsorbed state before irradiation. Author

N70-15449# Japan Atomic Energy Research Inst., Ibaraki.
ESR STUDY OF GAMMA-IRRADIATED AMMONIA-SILICA GEL SYSTEM
Siro Nagai, Shun-ichi Ohnishi, and Isamu Nitta *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 6–12 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Ammonia–silica gel system was gamma irradiated at 196 C. ESR spectrum observed from this system exhibited anomalous line widths among the *hf* lines. This spectrum was assigned to the NH2 radicals which are rotating slowly about the axis perpendicular to the radical planes. Qualitive explanation of the anomalous line widths was made using the model mentioned above. Also were discussed the motional effects on the ESR spectra of NH2 radicals in the matrices of water and of ammonia. Author

N70-15450# Japan Atomic Energy Research Inst., Ibaraki.
EFFECTS OF IRRADIATION ON PLATINUM-OXYGEN ELECTRODE
Kozo Hirota and Motoyoshi Hatada *In its* Osaka Lab. for Radiation Chem., vol. 2 1969 p 13–17 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Effects of irradiation on the potential vs. polarizing current curve was studied. Platinum-oxygen electrodes in aqueous potassium hydroxide solution were used. Polarization of the oxygen electrode, irradiated with electron beams from a Van de Graaff accelerator, was found to decrease to one seventh of that of the unirradiated electrode at the polarization current of 2.6 mA. A similar experiment was also carried out under intermittent irradiations and the component which responds to the pulsed irradiation was observed up to the frequency of 1,000 c/sec. The effects observed in the present research may be explained partly by the rise of local temperature at the electrode surface and partly by intermediates produced during irradiation. Author

N70-15451# Japan Atomic Energy Research Inst., Ibaraki.
SPECTROSCOPIC STUDIES ON RADIATION-INDUCED POLYMERIZATION. 3: ABSORPTION SPECTRA OF IRRADIATED ISOBUTENE AND ITS POLYMERIZATION IN LOW TEMPERATURE ORGANIC GLASSES
Hideo Kamiyama, Koichiro Hayashi, and Seizo Okamura *In its* Osaka Lab. for Radiation Chem., vol. 2 1969 p 18–26 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

With solutions of isobutene in organic glasses and several kinds of solvents, absorption bands were observed in the range of 220–2000 millimicrons at liquid nitrogen temperature. Intensity decrease of the 6128/cm band, characteristic to the monomer, was measured. In the glass of saturated hydrocarbons, such as isopentane and 3-methyl hexane, cationic polymerization was propagated at 77 K, and a very broad band appeared near 290 millimicrons. The propagating species was butyl carbonium cation. In the glass of polar solvent, n-butyl chloride, the polymerization was initiated only after warming and a band appeared at 660 millimicrons. This band was regarded to belong to the precursor of the initiating species. Author

N70-15452# Japan Atomic Energy Research Inst., Ibaraki.
SPECTROSCOPIC STUDIES ON RADIATION-INDUCED POLYMERIZATION. 4: ABSORPTION SPECTRA OF IRRADIATED ACRYLONITRILE AT THE LOW TEMPERATURE GLASSY STATE
Teiitsu Takagi, Hideo Kamiyama, Koichiro, and Seizo Okamura *In its* Osaka Lab. for Radiation Chem., vol. 2 1969 p 27–32 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

The active species and the reaction mechanism of gamma-ray induced copolymerization of acrylonitrile and propylene in the presence of zinc chloride were studied by means of electronic absorption spectra in organic glass. A system of ethanol, which was used as the solvent of copolymerization, and a rigorously dried system of 2-methyl tetrahydrofurane were treated. Alpha-Propionitrile radical in the former and acrylonitrile anion radical in the latter were observed respectively. In the presence of zinc chloride, active species was observed near 320 millimicrons in both systems and tentatively assigned to monovalent Zn cation, which was formed by electron capture from Zn(++). Author

N70-15453# Japan Atomic Energy Research Inst., Ibaraki.
RADIATION-INDUCED COPOLYMERIZATION OF STYRENE AND ACRYLONITRILE IN EMULSION SYSTEM
Hideo Kamiyama and Seizo Okamura *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 33–36 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Radiation induced copolymerization of styrene and acrylonitrile in emulsion system was studied using a few kinds of detergents. When nonionic detergent was used, maximum of rate of conversion was observed near equimolar composition of monomer mixture. Teis irregular behavior was discussed in relation to the radiation effect on initiation mechanism of the copolymerization. Author

N70-15454# Japan Atomic Energy Research Inst., Ibaraki.
RADIATION-INDUCED POLYMERIZATION IN EMULSION SYSTEM USING CATIONIC SURFACTANT. 1: CHARACTERISTIC PROPERTIES OF PRODUCED POLYMER EMULSION
Kosi Ohdan and Seizo Okamura *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 37–44 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Vinyl acetate and methyl acrylate were polymerized in aqueous system with a cationic surfactant by gamma-ray irradiation. The resultant emulsions were compared to the emulsions prepared by conventional method, namely polymerized by adding radical polymerization initiators or emulsified by anionic or non-ionic surfactant. As a result, some properties, such as heat stability and stability to coalescence by electrolytes, were found to be superior using the aqueous system. The cationic methyl acrylate-N-methylol acrylamide copolymer emulsion was able to be deposited electrophoretically on cathode surface. Author

N70-15455# Japan Atomic Energy Research Inst., Ibaraki.
RADIATION-INDUCED COPOLYMERIZATION OF OLEFINS IN THE PRESENCE OF METAL SALTS
Kanae Hayashi and Koichiro Hayashi *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 45–49 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Radiation induced copolymerization of olefins with vinyl monomers has been carried out in the presence of equimolar concentrations of metal salts in ethanol solution. In cases of ethylene–acrylonitrile and propylene–acrylonitrile, the addition of ZnCl2 increased the rate of polymerization and gave a copolymer of higher olefin content. However in cases of propylene–vinyl chloride and propylene–methyl methacrylate, ZnCl2 showed no significance in copolymer composition, though an increase in the polymerization rate was observed in the former case. The effects of

polymerization temperature, solvents and the other metal salts on copolymerization were also studied. Author

N70-15456# Japan Atomic Energy Research Inst., Ibaraki.
RADIATION- AND PHOTO-INDUCED COPOLYMERIZATION OF ARCYLONITRILE AND PROPYLENE IN THE PRESENCE OF METAL SALTS
Teiitsu Takagi, Hideohkamiyma, and Koichiro Hayasei *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 50–52 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Gamma-ray-induced copolymerization of acrylonitrile and propylene was studied in the presence of various kinds of metal salts. It was found that, in the absence of metal salts, the copolymerization propagated considerably, and some metal salts, such as zinc chloride, showed a positive effect on the rate of polymerization and copolymer composition. In order to compare with gamma-ray, ultraviolet irradiation was also studied. Marked differences in monomer composition of copolymer were not observed between them. Author

N70-15457# Japan Atomic Energy Research Inst., Ibaraki.
RADIATION-INDUCED COPOLYMERIZATION OF FORMALDEHYDE IN LIQUID CARBON DIOXIDE
Yahiko Toriuchi, Koichiro Eayashi, and Seizo Okamura *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 53–58 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Radiation-induced copolymerization of formaldehyde with various vinyl monomers and cyclic ethers in liquid carbon dioxide at 0 C was studied. Styrene, alpha-methyl styrene, isobutene, vinyl ethers and styrene oxide were able to copolymerize with formaldehyde. It was concluded that polymerization in this system proceeded by cationic mechanism. The copolymerization product was partly containing formaldehyde homopolymer, but the main part of it was thermally stable copolymer. The ratio of thermally stable copolymer to formaldehyde homopolymer increases with the comonomer content in monomer mixture and polymerization time. Author

N70-15458# Japan Atomic Energy Research Inst., Ibaraki.
EFFECT OF OXYGEN AND WATER ON THE PRE-IRRADIATION GRAFTING TO CELLULOSE
Toshio Okada, Kanako Kohdera, and Ichiro Sakurada *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 59–65 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

The effect of the presence of oxygen and water on the preirradiation grafting to cellulose was studied. Grafting of styrene to cellulose fibers of polynosics, regular rayon and cotton irradiated in different conditions with gamma-rays was carried out at 50 C. When the fibers were irradiated in dry state the presence of oxygen during the irradiation have small effect on the degree of grafting. The presence of adsorbed water in the fibers during irradiation decreases the degree of grafting greatly, especially for polynosics and regular rayon. Similar behaviors were observed for the grafting at 80 and 117 C and the extent of grafting decreased with increasing temperature of the grafting. The ESR measurements of free radicals were also carried out for the cellulose fibers irradiated in different conditions. In case of the irradiation of dry samples oxygen had no obvious effect on the amount and nature of the radicals. The presence of water during irradiation decreased the formation of radicals markedly and modified the hyperfine structure. From these results it can be concluded that the grafting to cellulose fibers is initiated not by peroxides but by trapped radicals independent of the presence or absence of oxygen during preirradiation. Author

N70-15459# Japan Atomic Energy Research Inst., Ibaraki.
GRAFTING OF ACRYLONITRILE ONTO POLYVINYL CHLORIDE FIBER
Ichiro Sakurada, Masao Hosono (Kyoto Unov.), and Toshio Okada *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 66–73 (See N70-15447 04-06)
Avail: CFSTI

Grafting of acrylonitrile onto undrawn polyvinyl chloride fibers was carried out using simultaneous irradiation ancatalytic methods. Drawing of the grafted fibers was also studied to give fibers was carried out using simultaneous irradiation and catalytic Radiation method is preferable to catalytic one from the following points: (1) Graft yield, especially when percent graft greater than 50 percent is concerned is higher in the case of radiation induced grafting than the catalytic one. (2) Under every conditions of drawing, grafted fibers by radiation could be drawn more smoothly than catalytically grafted ones. (3) When the degree of grafting and drawing of the grafted fiber by radiation is the same as that prepared by catalytic method, the former showed better tensile properties. (4) Grafted fiber by catalytic method was generally milky and turbid whereas that by radiation method was transparent. The above mentioned difference between two methods may be attributed to the difference of temperature of grafting; the radiation induced grafting was carried out at room temperature whereas the catalytic grafting had to be carried out at higher temperature 60 C. Author

N70-15460# Japan Atomic Energy Research Inst., Ibaraki.
RADIATION INDUCED GRAFT COPOLYMERIZATION TO POLYESTER. 3: GRAFTING OF ACRYLIC ACID TO DRAWN POLYETHYLENE TEREPHTHALATE FIBER WITH IMPREGNATION METHOD
Toshio Okada and Ichiro Sakurada *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 74–78 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Drawn polyethylene terephthalate (DET) fibers were impregnated with acrylic acid or its solution in organic solvents, particularly in ligroin and then subjected to the irradiation of gamma-rays from Co-60 in nitrogen atmosphere at doses necessary to complete polymerization of impregnated monomer. When the samples were irradiated at room temperature, most parts of polyacrylic acid formed were extracted off from the fiber with water at 100 C whereas with the irradiation at temperatures above 100 C almost all polymer formed by the irradiation could not be extracted. This indicates that nearly whole amount of acrylic acid impregnated can apparently be graft copolymerized to the fiber with irradiation at above 100 C. By this technique, graft PET fibers up to 30 percent graft can be prepared with good openability, that is without mutual adhering of fibers. Author

N70-15461# Japan Atomic Energy Research Inst., Ibaraki.
STAIN RELEASE TREATMENT OF POLYESTER FABRICS BY RADIATION-INDUCED GRAFTING
Motoaki Urakami and Toshio Okada *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 79–83 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

The grafting of acrylic acid to polyester fabrics were studied with impregnation method. The fabrics impregnated with acrylic acid solution were irradiated in air at room temperature with 1.5 MeV electrons from Van de Graaff accelerator. Under such conditions the product showed less than 10 percent of graft. Repeating of impregnation irradiation steps was useful to obtain fabrics of higher percent graft. Resulting graft fabrics were hydrophylic and have soil release ability. Alkali pretreatment of fabrics prior to the grafting was found to be effective to obtain the grafts of good stain release. Effects of irradiation temperature, solvent and atmosphere on the grafting to fabrics were also investigated with immersion method

using gamma-rays. It was found that the grafting takes place very smoothly when the fabrics were immersed in a mixture of acrylic acid and nonswelling agent such as ligroin and kerosine followed by irradiation with gamma-rays at the temperature range of 80 to 150 C. Author

N70-15462# Japan Atomic Energy Research Inst., Ibaraki.
VISCOELASTIC BEHAVIOR OF POLY(VINYL-ALCOHOL)-METHYL METHACRYLATE GRAFT COPOLYMER
Yasuo Suzuki and Toshio Okada *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 84-88 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Polyvinyl alcohol (PVA)-g-(methyl methacrylate) (MMA) was prepared by preirradiation technique. The true graft copolymer was isolated by the same method as reported previously. Studies were carried out on the graft copolymer with one branch whose chain length was nearly the same as to that of the backbone polymer. For comparison the studies were also carried out on the conventional graft copolymer which is considered as the mixture of true graft copolymers, PVA and PMMA. The viscoelastic properties of the true graft copolymer were observed to be similar to that of conventional one over the temperature range of 20 to 170 C. Dynamic loss tangent-temperature curves for two kinds of graft copolymers showed the existence of two transitions. The one which appeared in lower temperature region of about 60 C corresponds to the glass transition of the PVA part in the graft copolymer. This transition temperature in the graft copolymer is lower than that of pure PVA. In the higher temperature range a sharp peak appeared at 145 C for both graft copolymers. This sharp peak may be attributed to transition of PMMA polymerized within crystalline PVA. Probably the PMMA segments in the neighbor of PVA crystalline regions are under sufficient stress to increase their transition temperature. Author

N70-15463# Japan Atomic Energy Research Inst., Ibaraki.
VISCOELASTIC BEHAVIOR OF POLY(ETHYLENE TEREPHTHALATE)-STYRENE GRAFT COPOLYMER
Yasuo Suzuki and Toshio Okada *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 89-93 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Viscoelastic properties were studied on the graft copolymers of styrene which were prepared with amorphous polyethylene terephthalate (PET) fiber by mutual irradiation. Effect of heat treatment after grafting were also examined on the viscoelastic properties. The samples used were conventional graft copolymers which were composed of true graft copolymer, ungrafted PET and polystyrene. It was found that the small amount of solvent remained in graft copolymer affects very markedly its viscoelastic behavior. The loss tangent-temperature curves indicate two glass transitions, one at 100 to 105 C corresponding to the transition temperature of amorphous PET phase and the other at 107 to 110 C corresponding to the polystyrene phase. This result indicates that the graft copolymer consists of two separate phases of the component polymers, amorphous PET and polystyrene. Author

N70-15464# Japan Atomic Energy Research Inst., Ibaraki.
VISCOELASTIC BEHAVIOR OF POLY(ETHYLENE TEREPHTHALATE)-4-VINYL PYRIDINE GRAFT COPOLYMER
Yasuo Suzuki and Toshio Okada *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 94-97 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Poly(ethylene terephthalate) -g -4 -vinyl pyridine (PET-g -4 -VP) fiber was prepared by mutual irradiation. Amorphous PET fibers were used as the starting fibers, which were subjected to gamma rays while immersed in an aqueous emulsion of 4-VP. The samples used in this study were conventional graft fibers which were composed of true graft copolymer, ungrafted PET and 4-VP polymer. Viscoelastic measurements were carried out over the temperature range of 20 to 200 C. Glass transition temperature of 4-VP polymer was determined to be 151 to 156 C from dynamic loss tangent-temperature curve. PET-g-4-VP graft fiber showed a single broad transition which lay between the transitions of two component polymers. The transition temperature of graft copolymer was observed to rise by increasing the degree of grafting. It is concluded that the component polymers are more or less molecularly mixed in the graft fiber. Author

N70-15465# Japan Atomic Energy Research Inst., Ibaraki.
A COMPARISON OF RADIATION- AND CONVENTIONAL CATALYTICALLY-INDUCED POLY(VINYL CHLORIDE)-ACRYLONITRILE GRAFT FIBERS AT VISCOELASTIC BEHAVIOR
Yasuo Suzuki and Toshio Okada *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 98-102 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Poly(vinyl chloride)-g-acrylonitrile (PVC-g-AN) fibers by radiation method have advantages of high drawing ability and excellent transparency over catalytically grafted ones. In order to investigate the difference of these properties studies of viscoelastic properties were carried out on two types of graft polymers. Temperature curves for PVC-g-AN fibers showed the existence of two transition temperatures, which correspond to the glass transition temperatures of PVC and PAN phases, respectively. Transition temperatures of graft fibers by radiation were practically independent of the degree of grafting whereas those of catalytically produced ones shifted towards higher temperatures as the degree of grafting increased. The shapes of dynamic loss tangent-temperature curves show that the amount of phase mixing is larger in the radiation-induced grafted fibers than in the catalytically grafted ones. The differences of properties between two types of graft fibers may be at least partly attributed to the difference in the degree of mixing of the two component polymer phases. Author

N70-15466# Japan Atomic Energy Research Inst., Ibaraki.
RADIATION CURING OF MIXTURE OF DIALLYPHTHALATE PREPOLYMER AND VINYL MONOMER. 1: EXAMINATION OF FUNDAMENTAL CONDITIONS FOR RADIATION CURING OF MIXTURE OF DIALLYPHTHALATE PREPOLYMER AND VINYL MONOMER
Masao Gotota, Tadashi Tsuji, Akiyoshi Manabe, Tamotsu Takeuchi, and Ikuo Azato *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 103-110 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Diallylphathalate resin has many excellent properties, e.g. electrical characteristics, weatherability etc., but is being produced commercially by the troublesome, time consuming hot press curing method. A new method of radiation (especially electron beam) curing can be applied to this resin by mixing a suitable monomer and peroxide catalyst to diallylphathalate prepolymer and irradiating them after fabrication. Post curing effect was also examined, with the result that curing does not continue after irradiation for a long time, but occurs by short heating presumably owing to the thermal (and catalytic) polymerization and subsequent crosslinking. Author

N70-15467# Japan Atomic Energy Research Inst., Ibaraki.
RADIATION CURING OF MIXTURES OF DIALLYLPHTHALATE PREPOLYMER AND MONOMER. 2: STUDIES ON ELECTRON BEAM CURING OF MIXTURES OF DIALLYLPHTHALATE PREPOLYMER AND MULTI COMPONENT

MONOMERS, AND ITS APPLICATION TO DECORATIVE LAMINATE FOR WOOD VENEER

Masao Gotoda, Kenji Yokoyama, Takashi Kodama, and Yoshimi Kohno *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 111–124 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Diallylphathalate prepolymer can be cured by gamma-ray or electron beam irradiation by blending it with a suitable monomer. Several fundamental conditions for curing DAPp and monomer (and peroxide catalyst) mixture were examined. From these results, perfect curing of such mixtures (e.g. DAPp, vinyl acetate (VAc), and Benzoyl peroxide (BPO)) is rather difficult by electron beam irradiation which is of interest for the industrial application of this kind of resin for coatings. This last point prompted the present study on the modification of DAPp – VAc – BPO mixture by using the multi-component monomer and also the post curing effect for promoting curing. Further, the application of this resin system to decorative laminate for wood veneer was tried and found to have excellent properties for practical use. Author

N70-15468# Japan Atomic Energy Research Inst., Ibaraki.
PREPARATION OF WOOD-POLYMER COMPOSITE BY IONIZING RADIATION. 1: RADIATION-INDUCED POLYMERIZATION OF VINYLIDENE CHLORIDE IMPREGNATED IN WOOD

Masao Gotoda, Tadashi Tsuji (Koukoku Rayon and Pulp Co.), Kazuo Tsubomoto (Doshisha Univ.), and Yasuhiko Hagito (Doshisha Univ.) *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 125–134 (See N70-15447 04-06)
Avail: CFSTI

Radiation induced polymerization of vinylidene chloride (VDC) and other comonomers in wood and the investigation of the properties of this wood-polymer composite (WPC) is initiated for the purpose of improving the inflamability and dimensional stability of wood. Among the several home grown woods, checked for this purpose, beech was found to be most suitable. Gamma-ray and electron beam induced polymerization of VDC in beech was tried, with special reference to presoaked moisture in wood. Conversion of VDC by electron beam irradiation was very low, whereas that by gamma irradiation was very high and the required irradiation dose was also very small. Bulking effect produced by polymerization of VDC in wood, was found very small in the case of gamma irradiation but becomes pronounced in the case of electron beam irradiation, especially for the wood with much moisture. Improvement of the hygroscopic properties of beech – polyvinylidene chloride (PVDC) composite is correlated with these phenomena, and improvement of hygroscopic properties is larger by electron beam irradiation than by gamma-ray irradiation. Dimensional stability becomes much improved by only small polymer loading in the case of electron beam irradiation of wood with much moisture. Author

N70-15469# Japan Atomic Energy Research Inst., Ibaraki.
PREPARATION OF WOOD-POLYMER COMPOSITE BY IONIZING RADIATION. 2: GAMMA RAY INDUCED COPOLYMERIZATION OF VINYLIDENE CHLORIDE AND METHYLMETHACRYLATE AND/OR ACRYLIC ACID IN BEECH

Masao Gotoda, Tadashi Tsusi (Kokoku Rayon and Pulp Co.), and Kazuo Tsubomoto (Doshisha Univ.) *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 135–143 refs (See N70-15447 04-06)
Avail: CFSTI

The preparation of wood polymer composites by ionizing radiation, gamma-ray induced copolymerization of vinylidene chloride and methylmethacrylate and/or acrylic acid in beech was investigated. For the purpose of obtaining the continuous polymer and also to let it make intimate contact with cell walls inside the wood by swelling, methylmathacrylate and/or acrylic acid were chosen as comonomers of vinylidene chloride. Gamma ray induced polymerization of these comonomers in beech and also the hygroscopic properties of WPC thus obtained were examined with special reference to the effect of water, either presoaked in wood or added in these impregnants. As a result, acrylic acid was found to accelerate the polymerization of vinylidene chloride in wood, whereas methylmethacrylate has the inverse affect. Additions of small amounts of water does not affect the copolymerization rate. By choosing proper composition of these comonomers (especially in the case of VDC and AA), dimensional stability of the wood is greatly improved. Author

N70-15470# Japan Atomic Energy Research Inst., Ibaraki.
PREPARATION OF WOOD-POLYMER COMPOSITE BY IONIZING RADIATION. 3: GAMMA RAY INDUCED POLYMERIZATION OF VINYLIDENE CHLORIDE AND METHYLMETHACRYLATE WITH POLYETHYLENEGLYCOL IN BEECH

Masao Gotoda, Tadashi Tsuji (Kokoku Rayon and Pulp Co.), and Yasuhiko Hagito (Doshisha Univ.) *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 144–156 refs (See N70-15447 04-06)
Avail: CFSTI

By adding polyethyleneglycol, gamma-ray induced polymerization in beech is accelerated, but to promote the bulking and dimensional stabilization of wood, the presence of water was found to be necessary. The water added to these impregnants is not effective, but the water presoaked in wood has a pronounced effect. The effect of molecular weight of polyethyleneglycol is investigated; polyethyleneglycol 600 mainly used in this experiment caused dampness of the wood polymer composite especially in humid conditions. Author

N70-15471# Japan Atomic Energy Research Inst., Ibaraki.
STUDY OF THE ENERGY LOSS FUNCTION OF ELECTRONS BY VACUUM ULTRAVIOLET TECHNIQUE. 1: EXPERIMENTAL APPARATUS AND REFLECTANCE OF POLYSTYRENE

Yohta Nakai, Kosi Matsuda, Torao Takagaki, and Ki-iChi Kimura *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 165–168 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

The reflectance measurements of polystyrene as a typical polymer, and the optical properties of similar polymers in the vacuum ultraviolet region are investigated to determine the energy loss function of electrons in solid polymers. Author

N70-15472# Japan Atomic Energy Research Inst., Ibaraki.
TUNNELING OF LOW ENERGY ELECTRON AND ELECTRIC PROPERTIES OF METAL THIN POLYMER-METAL SYSTEM. 1: PREPARATION OF SEVERAL KINDS OF EXTREMELY THIN POLYMER AND THEIR ELECTRIC PROPERTIES

Torao Takagaki, Yohta Nakai, Kosi Matsuda, and Ki-iChi Kimura *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 169–174 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

An exploratory study concerned with the establishment of technique for the formation of extremely thin polymer films on metal film substrate is reported. The essential purposes of this study are to establish the behavior of low energy electron in polymers, and applicability of these polymers in new electronic devices. Results prove that the glow discharge method is acceptable for making thin, uniform and no pinhole polymer films, and the voltage – current characteristics of these films are nonohmic. Photoelectric effect of metal – polymer – metal system in the vacuum ultraviolet region is also investigated. Author

N70-15473# Japan Atomic Energy Research Inst., Ibaraki.
RADIATION EFFECTS ON SOME METAL

ACETYLACETONATES (PRELIMINARY REPORT)
Motoyoshi Hatada, Siro Nagai, Shun-iChi Ohnishi, and Isamu Nitta *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 175–179 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Radiation effects on the five metal acetylacetonates: Be(acac)2, Mg(acac)2, Al(acac)3, Zn(acac)2 and Zr(acac)4 were studied by ESR technique. All the spectra of the irradiated acetylacetonates except that of Be(acac)2 are similar to one another, but they differ slightly in shape according to their metal ions. The spectrum of the irradiated Be(acac)2 was regarded as a double-septet at −198 C and changed its shape significantly with increasing temperature. This report presents the preliminary results of the ESR study of the acetylacetonates and the results of the analysis of the thermoluminescent curve of irradiated Be(acac)2. Author

N70-15474# Japan Atomic Energy Research Inst., Ibaraki.
RADIOLYSIS OF METHYL ETHYL ETHER
Jun'ichi Takezaki and Kozo Hirota *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 180–184 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Primary products of radiolysis of methylethyl ether in gas phase and their G values are as follows: H2 4.7, CO 0.51, CH4 0.25, and C2H4 0.18. Radiolysis of deuterated ethers are investigated and the formations of hydrogen and methane are discussed. Author

N70-15476# Japan Atomic Energy Research Inst., Ibaraki.
IRRADIATION EFFECTS OF GRAMICIDIN
Shun-ichi Sugimoto, Shun-ichi Ohnishi, and Isamu Nitta *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 185–189 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Irradiation effects of gamma irradiated gramicidin were studied by ESR, amino acids analyses, column chromatographs on Sephadex, and biological activity tests. The main ESR component observed at room temperature consists of nine lines (splitting 6 Gauss). The free radical responsible for this nonet can be assigned to phenylalanine radical. Radical accumulation curves were measured at room temperature and −196 C. Initial formation GR values of irradiated samples were about unity at both temperatures. Amino acids analyses showed that proline residue was the most radiation resistant amino acid. When irradiated in vacuum in polycrystalline state, phenylalanine residue was radiation resistant. On the other hand, when irradiated in air or in solution of methyl alcohol-water (2: 3), the phenylalanine residue decreased most remarkably. Author

N70-15478# Japan Atomic Energy Research Inst., Ibaraki.
RADIATION-INDUCED POLYMERIZATION OF ADSORBED MONOMERS. 1: VINYL MONOMERS ON SILICA GEL
Akira Shimizu (Mitsubishi Petrochemical Co.), Koichiro Hayashi, and Seizo Okamura *In its* Osaka Lab. for Radiation Chem., vol. 2 1969 p 190–193 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Radiation induced polymerization of vinyl monomers adsorbed on silica gel was studied. Monomers studied were butadiene, methyl methacrylate, acrylonitrile, and styrene. Polymerizations of these monomers adsorbed on silica gel in a monolayer concentration show a great polymerization rate enhanced by an energy transfer from silica gel to the adsorbed monomers. A difference in an adsorbed state polymerization from an ordinary bulk polymerization was observed also in a different dose rate dependency of the polymerization rate, in the case of methyl methacrylate polymerization. Polymers prepared in an adsorbed state did not show any characteristic structure by IR and NMR spectra. The reactivity ratios in the copolymerization of acrylonitrile and methyl methacrylate were not different from those of a bulk copolymerization. Polymerization mechanism of methyl methacrylate in a silica gel was studied by ESR spectroscopy and the propagating radical was observed. Author

N70-15477# Japan Atomic Energy Research Inst., Ibaraki.
STUDIES ON RADIATION-INDUCED FREE IONIC POLYMERIZATION BY ELECTRICAL CONDUCTIVITY MEASUREMENTS. 1: ISOBUTYL VINYL ETHER (PRELIMINARY REPORT)
Kanae Hayashi, Koichiro Hayashi, and Seizo Okamura *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 194–195 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

Radiation induced polymerization of isobutyl vinyl ether was carried out under the simultaneous measurement of electrical conductivity. In a superdried sample where a half power dependence of the rate of polymerization on dose rate was achieved, the specific conductance was decreased to half of that in the non dried one. The rate constant for free ionic propagation is given. Author

N70-15479# Japan Atomic Energy Research Inst., Ibaraki.
STUDY ON THE REACTIONS OF THE ACTIVE SPECIES IN IRRADIATED ORGANIC SOLIDS BY DIFFERENTIAL THERMAL ANALYSIS
Masanobu Nishii, Koichiro Hayashi, and Seizo Okamura *In its* Osaka Lab. for Radiation Chem., Vol. 2 1969 p 196–198 refs In JAPANESE; ENGLISH summary (See N70-15447 04-06)
Avail: CFSTI

A decay process of the active species trapped in gamma-irradiated organic solids has been studied by the differential thermal analysis. For this purpose, an apparatus for low temperature differential thermal analysis was constructed. This apparatus is able to analyze over the temperature range from −205 to +120 C. From differential thermal analysis curves of the crystalline methanol gamma irradiated at −196 C, an exothermic peak was found in the temperature range from −131 to −116 C. This exothermic peak shows that trapped active species disappeared in this temperature range which is lower than the phase transition point (−114 C) of methanol. In the case of gamma irradiated acrylic acid, an exothermic peak of the decay process of trapped active species was not observed, but it was found that the post-polymerization proceeds in low temperature region which is lower than the reported polymerizable temperature region. Author

N70-15479# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
A STUDY OF THE FORMATION OF THE 1.15 MICROMETER SPECTRAL LINE OF NEON IN A DC DISCHARGE
George A. Tsongas, Sotiris P. Koutsoyannis, and Krishnamurty Karamcheti Aug. 1969 84 p refs
(Contract Nonr-225(61))
(AD-694977; Rept-386) Avail: CFSTI CSCL 7/4

An investigation was conducted to study the effects of the kinetic state of an absorbing gas on the formation of its spectral lines. The spectral line profile of the 1.15 micrometer transition in Ne(22) was measured over a range of dc discharge pressures and currents using tuned laser absorption spectroscopy with He-Ne tunable laser light source oscillating at 1.15 micrometer. The measured shapes and lineshape parameters were compared with those predicted by the theories of spectral line formation. The influence of the state of the gas on its spectral line structure was then deduced from that comparison between the results of theory and experiment. The measured lineshapes were fitted with both Voigt profiles and Rautian-Sobelman profiles (strong-collision model). The latter profiles account for the effects of velocity-changing collisions, which can produce narrowed lineshapes. Under certain

conditions, collisional line narrowing was observed; this was inferred from the fits of Rautian-Sobelman profiles, which fit the measured lineshapes when Voigt profiles did not. Author (TAB)

N70-15486*# AiResearch Mfg. Co., Los Angeles, Calif.
DEVELOPMENT OF SODIUM CHLORATE CANDLES FOR THE STORAGE AND SUPPLY OF OXYGEN FOR SPACE EXPLORATION APPLICATIONS Final Report
Jack Littman 18 Jul. 1969 124 p refs
(Contract NAS9-7556)
(NASA-CR-102070; Rept-69-4695) Avail: CFSTI CSCL 07D

A sodium chlorate candle formula and a candle ignition device were developed which provide a reliable, high-purity source of oxygen suitable for many space exploration applications. The contaminant level of the candle was reduced so that little or no post-candle clean up is necessary. Dry processing methods have been used to reduce the water content of the candle, and the chlorine contaminant levels in the effluent oxygen. The barium peroxide normally found in candles as a chlorine evolution suppressant is therefore not required in the formula. This has the added advantage of reducing CO and CO2 contamination due to the impurities normally found in commercially available barium peroxide. Methods of candle fabrication were evaluated from the viewpoints of the quality of the candle produced and the applicability to commercial production. Promising techniques to produce high density, uniform candles are hydrostatic compression and extrusion. Author

N70-15488# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
DIFFUSION AND HETEROGENEOUS REACTION 13: MEASUREMENTS OF O-O2 DIFFUSION AS A FUNCTION OF TEMPERATURE
Henry Wise, Robert S. Yolles, and Leonard Mc Culley Aug. 1969 29 p refs Prepared in cooperation with Stanford Res. Inst., Menlo Park, Calif.
(Contract N00014-67-A-0226-0005)
(AD-693972; SQUID-TR-SRI-29-PU) Avail: CFSTI CSCL 7/4

Steady-state and time-transient measurements of the decay of oxygen atoms in a cylinder with catalytic walls have been used to determine the diffusion coefficient of atomic oxygen in molecular oxygen over the temperature range 298 to 873K. The resulting temperature dependence of the O-O2 diffusion coefficient was fitted to a modified Buckingham potential. Measurements of the surface reaction rate of oxygen atoms on quartz gave a value for the recombination coefficient with little variation in temperature over the range studied. Author (TAB)

N70-15492*# Maryland Univ., College Park. Dept. of Chemistry.
ULTRASONIC STUDY OF TERTIARY BUTYL ALCOHOL IN CYCLOHEXANE
Frank Garland (Ph.D. Thesis) Jan. 1968 88 p refs
(Contracts NGL-21-002-008; DI-14-01-0001-405)
(NASA-CR-107570; Rept-7) Avail: CFSTI CSCL 07C

The ultrasonic absorption technique was used to study the self-association of t-butyl alcohol in cyclohexane at 5 C, 10 C, and 15 C. The absorption data were interpreted in terms of a single relaxation, and characteristic time constants of the association process were found. It is concluded from the variation of the time constants with concentration of alcohol that the relaxation is due to perturbation of a monomer-dimer equilibrium. The method used to calculate the time constants from the absorption data is discussed. Author

N70-15498*# Notre Dame Univ., Ind. Dept. of Chemistry.
EXPLORATORY POLYMER SYNTHESIS Quarterly Status Report, 1 Aug. – 31 Oct. 1969
G. F. D'Alelio 31 Oct. 1969 76 p
(Grants NGL-15-004-001; NsG-339)
(NASA-CR-107553) Avail: CFSTI CSCL 07C

Six heterocyclic Schiff base type monomers were prepared by the reaction of the appropriate carbonyl compounds with selected amino compounds by a continuous azeotropic method using tolusene as the azeotropic agent. The yields of the crude product were less than, and the rates of condensation were slower than, similar reactions reported for the synthesis of carbo-cyclic Schiff bases using the continuous azeotropic technique. In the synthesis of aldazomethines, a catalyst was not required for the condensation; however, the ketazomethines required the use of a Lewis acid catalyst due to the lower reactivity of the ketone moiety compared to the aldehyde function. A seventh base was prepared by condensing the amine hydrochloride with the appropriate carbonyl compound in alcohol as the solvent. The desired product was obtained as a precipitation upon the neutralization of the solution aqueous sodium carbonate. Author

N70-15502# Stevens Inst. of Tech., Hoboken, N.J. Castle Point Station.
A FORTRAN 4 COMPUTER PROGRAM FOR THE CALCULATION OF MOLECULAR WEIGHTS BY SEDIMENTATION EQUILIBRIUM
J. Ehrlich, D. Liddle, and S. S. Stivala 9 Sep. 1969 25 p Submitted for publication Sponsored in part by US Public Health Service
(Contract N00014-68-A-0131)
(AD-695009; ONR-TR-13) Avail: CFSTI CSCL 7/4

A computer program for the calculation of molecular weights by sedimentation equilibrium from interference pattern data is presented. This method yields rapid and accurate results directly from reading the Rayleigh fringes without any other intermediate steps or calculations. There is also a provision which can be used for eliminating statistically, outlying experimental points. Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-14138# Stanford Research Inst., Menlo Park, Calif.
A STUDY OF LAND MOBILE SPECTRUM UTILIZATION. PART B: ANALYSIS OF THE SPECTRUM MANAGEMENT PROBLEM Final Report
W. R. Vincent and T. I. Dayharsh Jul. 1969 49 p refs Prepared for Federal Commun. Comm.
(PB-184984) Avail: CFSTI CSCL 17B

The major findings of an investigation of the frequency assignment procedures used in the land mobile services are summarized. Modifications to present frequency assignment procedures are shown to be necessary to eliminate serious channel congestion problems and the maldistribution of users among channels. A combined national and regional spectrum management system is proposed to cope with the spectrum management problems of the land mobile services. The basic components of the national and regional centers are defined, and alternative approaches to their management structures are considered. Author (USGRDR)

N70-14185# Japan Broadcasting Corp., Tokyo. Radio Frequency Research Div.

STATISTICS OF ATTENUATION DUE TO PRECIPITATION OF RADIO WAVES IN 10 GHZ BAND AT HIGHER ANGLES OF ELEVATION

Akira Kinase and Akira Kinpara Aug. 1969 25 p refs *Its* No. 130

Avail: CFSTI

A method of measuring attenuation of radio waves due to precipitation at higher angles of elevation by the use of a radiometer is reported with several items of the results obtained from the measurements, which were performed during the past several years at 9.4 and 11.8GHz. A practical prediction method of attenuation-rate–surface rainfall statistics is developed on the basis of simultaneous records of solar and atmospheric noise and rate of surface rainfall. Author

N70-14184*# Alabama Univ., University. Communication System Group.

AM BASEBAND TELEMETRY SYSTEMS. VOLUME 4: PROBLEMS RELATING TO AM BASEBAND SYSTEMS

Richard S. Simpson and William H. Tranter Aug. 1969 49 p refs

(Contract NAS8-20172)

(NASA-CR-102373; TR-106-102) Avail: CFSTI CSCL 17B

An analysis is performed to determine the effect of channel carrier phases on the crest factor of an AM-baseband signal for dc and random modulation. Also, the manner in which a DSB signal is distorted when it drifts within the passband of a bandpass filter is investigated for a sinusoidal modulating signal. The effect of demodulation phase errors is studied for SSB, DSB, and quadrature DSB (QDSB) systems having random modulation. Finally, the effect of intermodulation distortion is studied for an AM-baseband, and the carrier phases which minimize the effect of intermodulation distortion are determined. Author

N70-14302# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ROZ-1 GROUND SEARCH RADAR

14 Feb. 1969 29 p Transl. into ENGLISH of the book "Radar Explorateur Du Sol" Russian p 1–26

(AD-696046; FTD-HT-23-1500-68) Avail: CFSTI CSCL 17/9

The ROZ-1 ground search radar is designed to be carried on board modern passenger aircraft and helicopters. It makes possible safe instrument flying and the accurate reading of aircraft coordinates. There are two versions of this radar installation which differ in the type of antenna employed. Both are composed of several individual units which can be arranged on board the aircraft in many different ways. These subsystems are the antenna (LTs1 or LTs1A), transmitter- receiver unit (LTs2/12), power supply and distribution box (LTs15A), radar indicator (LTs6), electronic unit (LTs28A), and the control console (LTs21). TAB

N70-14405# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SEPARATING OPTICAL SIGNALS IN THE PRESENCE OF RANDOM NOISE

N. S. Shestov 15 May 1969 386 p refs Transl. into ENGLISH of the book "Vydelenie Opticheskich Signalov Na Fone Sluchainykh Pomekh" Moscow, 1967 p 1–347

(AD-694845; FTD-HT-23-947-68) Avail: CFSTI CSCL 17/8

This book is intended for students, engineers, and scientists dealing with problems of the detection of various kinds of radiated signals against a background of random interference. On the bases of statistical theory, the book discusses problems of optimum discrimination signals against a noise background. The case of optical (light and heat) signals is considered. Particular attention is given to an analysis of a system using modulation of radiant flux and scanning and to methods of achieving multichannel detection systems. The theoretical material is accompanied by a considerable number of examples and practical recommendations. Author (TAB)

N70-14523# Army Foreign Science and Technology Center, Washington, D.C.

SOME PROBLEMS OF TRANSMISSION AND RECEPTION OF OPTICAL PULSED SIGNALS CONSIDERING THE DISCRETE NATURE OF FLUCTUATION NOISES

F. I. Khaitun et al 19 Sep. 1969 16 p refs Transl. into ENGLISH from Optiko-Mekhanicheskaya Promyshlennost, (Russian), v. 35, no. 5, 1968 p 1–6

(AD-695727; FSTC-HT-23-448-69) Avail: CFSTI CSCL 9/4

Certain problems in using devices for separating signals which arise as a result of the discrete nature of electrical currents and radiation are considered. Evaluation of the quality of a system which separates a signal in the presence of noises and interference is based on statistical criteria. Threshold relationships and the effectiveness of transform of energetic similarity given interference characterized by a Piisson distribution are considered. Author (TAB)

N70-14585# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN CHARACTERISTICS OF A GA AS OPTICAL QUANTUM AMPLIFIER

Yu. Moma et al 1 Jul. 1969 7 p refs Transl. into ENGLISH from Poluprov. Pribory v Tekhn. Elektr., Sb. Statei, 1968 p 141–145

(AD-695945; FTD-MT-24-127-69) Avail: CFSTI CSCL 20/5

The article gives results of the measurement of amplification factors of a semiconductor optical quantum amplifier OKU based on gallium arsenide, in pulse conditions at the temperature of liquid nitrogen. Conclusions are drawn as to the prospects of the application of OKU in optical communication lines. Author (TAB)

N70-14636# Stanford Univ., Calif. Stanford Electronics Lab.

ELECTRONIC RESEARCH PROGRAM IN NONCOMMUNICATION NAVAL ELECTRONICS TECHNIQUES Quarterly Status Report, 1 Mar.–31 May 1969

W. R. Rambo 31 May 1969 29 p refs

(Contract Nonr-225(59))

(AD-693999; SU-SEL-69-042; QSR-32) Avail: CFSTI CSCL 17/4

The following areas of research are reported: A technique for precision interpulse interval acquisition and tracking suitable for control purposes; Application of self-adjusting voltage filters to adaptive signal sorting; Real-time RF-DF phase monopulse receiver techniques; Navy consulting; Waveform synthesis and special measurement instrumentation; Solid-state microwave RF sources and companion elements. TAB

N70-14648# Japan Broadcasting Corp., Tokyo. Radio Frequency Research Div.

TELEVISION BRANCHING UNITS WITH BROADCASTING ISOLATOR

Yoshihiro Konishi and Norio Hoshino Aug. 1969 10 p refs *Its* Ser. 129

Avail: CFSTI

An antenna branching unit with a broadband isolator was developed which produced good S/I ratios for TV receivers. Results show that the branching unit was 40dB better than one using a directional coupler. The coupling coefficient of a transformer was changed at the branching point to a weaker coupling for reception on higher floors of tall buildings. A 75dB signal level at the antenna terminal was enough to supply a signal level of 60dB to each floor of a ten story building without an amplifier. J.A.M.

N70-14858# Ohio State Univ. Research Foundation, Columbus. Electro-Science Lab.
THE IMPERFECTLY-TIMED DEMODULATION OF DIFFERENTIAL PHASE SHIFT KEYED SIGNALS
Ronald J. Huff Sep. 1969 71 p refs
(Contract F30602-69-C-0112)
(AD-695504; RADC-TR-69-241; OSURF-2738-1) Avail: CFSTI CSCL 9/4

The effects of bit synchronization error on the performance of receivers used to demodulate differential phase shift keyed (DPSK) signals are analyzed. In the two cases of interest considered, the carrier signal is bi-phase modulated with either the differentially encoded (binary) data stream or the modulo two sum of the encoded data stream and a binary pseudo-noise (PN) signal. The bit timing error is assumed to be Gaussian distributed. Since the effects of both non-zero timing offset and random jitter are investigated, the results provide an adequate basis for the design of synchronizers as employed, for example, in time division multiple access systems. Author (TAB)

N70-14862# Army Foreign Science and Technology Center, Washington, D.C.
PROPAGATION OF CENTIMETER, MILLIMETER, AND SUB-MILLIMETER WAVES IN THE EARTH'S ATMOSPHERE
S. A. Zhevakin et al 24 Sep. 1969 52 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gor'kiy), v. 10, no. 9/10, 1967 p 1213–1243
(AD-694411; FSTC-HT-23-18-69) Avail: CFSTI CSCL 17/2.1

The article reviews the present state of knowledge concerning the propagation of microwaves in the earth's atmosphere. The effect of water vapor dimers and monomers as well as molecular oxygen are examined as they contribute to the total absorption coefficient. Three forms of the spectral lines are contrasted, namely that proposed by Lorentz, that proposed by Van Vleck and Weiskopf, and the form obtained from a solution of the kinetic equation. Natural atmospheric wave-guides are discussed briefly indicating why it is impractical to use them for communications. Author (TAB)

N70-14868# Army Foreign Science and Technology Center Washington, D.C.
THE OPTIMUM SHAPE OF NON-COHERENT PULSE SIGNALS
V. S. Trusov 19 Sep. 1969 11 p refs Transl. into ENGLISH from Vsesoyuznaya Nauchn. Sessiya, Posvyashchennaya Dnyu Radio no. 22, Sekts. Obshch. Radiotekhnikii. Dokl., (Moscow), 1966 p 48–52
(AD-695090; FSTC-HT-23-488-69) Avail: CFSTI CSCL 17/9

A method is shown for calculating the optimum shape for radar pulses which will insure minimum dispersion in estimates of distance to the target and speed of the target. Optimum pulse shapes are shown for different noise levels when pulse amplitude and phase modulation are present. Author (TAB)

N70-14988# California Univ., Berkeley. Survey Research Center.
AN EXTENDED ANALYSIS OF COMMUNICATIONS MATERIALS Final Report, 1 Aug. 1967–31 Jul. 1969
Paul Wong 10 Sep. 1969 14 p refs
(Grant AF-AFOSR-68-1348)
(AD-694589; AFOSR-69-2450TR) Avail: CFSTI CSCL 5/11

The original aim of the study was to determine whether mass communication materials could be used to study the social structure and social processes in Communist China. The method of inquiry was computerized content analysis. Articles were coded according to a systematically constructed scheme. The result of the study on mass communication demonstrated the fruitfulness of this approach. In addition to revealing previously little known facts about the mass communications system itself, the study examined the relationship between the press and society. Author (TAB)

N70-14995# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PROBABILITY DENSITY FUNCTION ESTIMATION WITH APPLICATIONS TO RECEIVER DESIGN FOR RECEPTION IN NON-GAUSSIAN NOISE Technical Note
James E. Evans 29 Aug. 1969 55 p refs
(Contract AF 19(628)-5167)
(AD-694552; TN-1969-47; ESD-TR-69-243) Avail: CFSTI CSCL 9/4

This note considers the problem of estimation of an unknown probability density function, P X, and the derivative of the logarithm of that density function, F X, given N samples from an ensemble whose probability density is P X. Our principle objective is to estimate F X since it has been shown that the optimal receiver for unknown threshold signals in additive white but possibly non-Gaussian noise consists of a filter matched to the signal preceded by a no-memory device. Although our approach is primarily motivated toward obtaining a good estimate of F X, the method and results would appear also to be applicable to finding 'good' estimates of P X. The 'goodness' of the estimation procedure is investigated theoretically and experimentally. Author (TAB)

N70-15055# Army Foreign Science and Technology Center, Washington, D.C.
THE POSSIBILITY OF SELF-FOCUSING ELECTROMAGNETIC WAVES IN THE IONOSPHERE
A. G. Litvak 14 Oct. 1969 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gor'kiy), v. 11, no. 9, 1969 p 1433–1435
(AD-696054; FSTC-HT-23-625-69) Avail: CFSTI CSCL 20/14

The possibility of self-focusing waves in the ionosphere is discussed. Since the effects of self-focusing markedly influence various non-linear effects accompanying propagation of an intense light beam in a non-linear medium, the requirements of non-linear optics associated with this phenomena are considered. It is concluded that the existence of self-focusing waves in the ionosphere is possible when using powerful transmitters operating in a continuous regime. Author (TAB)

N70-15116 Texas A&M Univ., College Station.
A METHOD OF INTERPOLATION OF SAMPLE DATA USING MULTIPLE CHANNELS
Donald Enos Todd (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-5158

Signals that can be assumed to be both time and frequency limited are considered. The interpolation scheme is most practical when a signal cannot be sampled at its Nyquist rate. In the scheme a set of prefilters is excited by an input signal. The responses of the prefilters are all sampled at the same time and stored. By using these sample values the input signal may be reconstructed later. The scheme is further simplified by using RC filters as prefilters. A method of selecting the bandwidths of the RC filters is given and application of the design procedure is illustrated for a transducer response. Dissert. Abstr.

N70-15181# Army Foreign Science and Technology Center, Washington, D.C.
PROTECTION OF A RADAR STATION FROM NONSYNCHRONOUS PULSE INTERFERENCE
A. G. Uuzan 25 Sep. 1969 12 p Transl. into ENGLISH from Vestn. Protivovozdushnoi Oborony (USSR), no. 5, 1968 p 61–64
(AD-695519; FSTC-HT-23-531-69) Avail: CFSTI CSCL 17/9

Nonsynchronous interference filters (NIF), based on the ability of potentialoscopes to separate the signal of nonsynchronous pulse interference, are described. Two schemes are given, which use readout cascade and gating methods, respectively. It is concluded that NIF using a potentialoscope with barrier screen possess sufficient reliability, despite their complexity. Author (TAB)

N70-15410# SHAPE Air Defense Technical Center, The Hague (Netherlands).
OPERATIONAL REQUIREMENTS FOR COMMAND AND CONTROL DISPLAYS WITHIN ACE
J. B. Came *In* AGARD Displays for Command and Control Centers Jul. 1969 p 15–21 (See N70-15408 04-08)
Copyright. Avail: CFSTI

Clear requirements are necessary to realize the full potential of modern displays within ACE. It is necessary to be more specific, focus on the most vital functions, and translate requirements into feasible system concepts. This chapter illustrates this approach and develops the display requirement for one of the most vital command and control functions within ACE. The first and most important command and control function regarding displays, especially at the nuclear threshold, is that of getting timely, operationally-adequate situation information to decision makers. Surprisingly, the same amount and type of information is required at most higher levels of command. This suggests a display system concept in which vital situation information could be broadcast simultaneously from selected reporting elements to all command centers requiring the information. Decision making and evaluation appropriate to each level of command could then be accomplished concurrently, thus greatly improving the responsiveness of the system. Author

N70-15411# Bundesanstalt fuer Flugsicherung, Frankfurt am Main (West Germany).
THE DEVELOPMENT OF A DISPLAY WORKING POSITION WITH UNIVERSAL APPLICATION FOR AIR TRAFFIC CONTROL FUNCTIONS
Kurt Heidelauf *In* AGARD Displays for Command and Control Centers Jul. 1969 p 23–35 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI

Reported is the development of a universally applicable display and control working position, 'Air Situation Display', which will be capable of displaying radar information in scan-converted TV presentation and additional synthetic data of limited extent in a manually operated data processing system, without computer; and of displaying synthetic air situation presentations with supplementary digital information and radar information in scan-converted TV presentation in an automated data processing system, with computer. The development of automation within the air traffic services involves: (1) the use of universal computer systems; (2) efficient computer input and output organization; (3) utilization of digitalized radar information (primary/secondary radar); (4) high total system reliability; and (5) representation of the control information in a concentrated form at display working positions (analog display for the air situation and digital display for supplementary information respectively). Author

N70-15413# Air Force Missile Test Center, Patrick AFB, Fla.
COMMAND AND CONTROL OF MANNED SPACE FLIGHT RECOVERY OPERATIONS
Joseph H. Magrane *In* AGARD Displays for Command and Control Centers Jul. 1969 p 49–66 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI

The purpose of this chapter is to explain the role of the Department of Defense Manager for Manned Space Flight Support Operations in the manned space flight program efforts of the United States of America and to discuss command and control of manned space flight recovery operations in particular. The method of research was based primarily upon the personal observations of the author, discussions with colleagues, and a review of the official records in files. The chapter shows that the current approach to and the complexity of displays for command and control of manned space flight recovery operations are adequate for the purpose and will be continued for the recovery missions planned in the foreseeable future. Author

N70-15438# General Electric Co., New York.
PROCESSING OF RADAR AND SONAR DATA FOR DISPLAY IN COMMAND AND CONTROL SYSTEMS
A. A. Albanese *In* AGARD Displays for Command and Control Centers Jul. 1969 p 405–418 (See N70-15408 04-08)
Copyright. Avail: CFSTI

This chapter emphasizes the use of digital techniques in the generation of displays. MIRAGE (Microelectronic Indicator for Radar Ground Equipment), a display data processor and a concept referred to as UNICON (Universal Control) are described as they apply to a radar system configuration. The emphasis is on tactical command and control, where size, weight, power and reliability considerations are major factors in the display subsystem design. The concept is developed by use of block diagrams, performance description and human factors evaluations. Photographs of the display surface or completed equipment are shown to demonstrate actual results achieved. The configuration proposed is based on improved reliability, mission flexibility, compatibility with digital computers, and payload improvements. Author

N70-15430# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).
A NEW EIDOPHOR LARGE SCREEN TV-PROJECTOR
Henry J. Duringer *In* AGARD Displays for Command and Control Centers Jul. 1969 p 435–442 (See N70-15408 04-08)
Copyright. Avail: CFSTI

This chapter is intended to acquaint the reader with the latest accomplishments achieved in the field of large screen television projection. Included is a discussion of the performance and features of a new prototype projector, a first series of which is planned to be made available during 1968. The introduction is for the benefit of those readers who may not have had an opportunity to become acquainted with the fundamentals of its operation. Author

N70-15439# Industrie Elettroniche Associate, Rome (Italy).
RADAR DIGITAL INDICATORS – TECHNICAL SOLUTIONS AND APPLICATIONS
Asbjorn Hunstad *In* AGARD Displays for Command and Control Centers Jul. 1969 p 443–456 (See N70-15408 04-08)
Copyright. Avail: CFSTI

Radar digital indicators are based on the generation in digital form of the deflection signals for the PPI display, and are therefore the most suitable to provide a composite display of raw radar and flicker-free symbols. A practically perfect registration between radar and symbols can be obtained without the need of cumbersome calibrations. This chapter includes discussion of the minimum and maximum values required for range scales and the number and shape of symbols to be shown in different positions on the screen. These factors determine the solution for the time sharing between radar and synthetic pictures and for the type of deflection system to be used. Use of digital circuits increases the reliability of digital indicators and simplifies maintenance and test equipment problems. The use of digital indicators appears to be convenient only when several indicators are working in a parallel connection to the same radar. In this case, the type of circuits used and the ease in distributing digital signals allow for implementing many functions common to all indicators in a single central unit. Author

N70-15489*# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrical Engineering.
A SPACE COMMUNICATIONS STUDY Final Report, 15 Sep. 1968–15 Sep. 1969
Donald L. Schilling, Raymond L. Pickholtz, and Kenneth K. Clarke 15 Sep. 1969 101 p refs
(Grant NGR-33-006-020)
(NASA-CR-107456; PIBEE-69-006) Avail: CFSTI CSCL 17B

The problems of receiving analog and digital signals which are transmitted through a noisy channel are studied. Frequency modulation is emphasized with particular attention to the problem of threshold extension. Spikes and cycle slips, and the frequency demodulator using feedback (FMFB) are discussed. Canonical equations are presented along with some results regarding extreme-case operation. Single sideband FM, arguments against its use, and optimum preemphasis are considered. An optimum preemphasis network has the advantage of providing a gain of 2dB or more. A slow scan digital TV system is described which is a complete computer controlled system that transfers information from a photographic slide into a stored digital form from which measurements and coding are possible. A recursive second order gradient algorithm is developed for the minimization of noise. These results applied to the theory of FM systems operations are considered significant. M.H.E.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-14150# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WORK FEATURES IN THE 'MINSK-222' SYSTEM
E. N. Zhukov et al 7 Apr. 1969 12 p ref Transl. into ENGLISH from Vychislitelnye Sistemy (USSR), no. 24, 1967 p 17–83
(AD-695190; FTD-MT-24-92-69) Avail: CFSTI CSCL 9/2

This article examines possible methods of starting the MINSK-222 system, describes conflict situations which arise in program debugging, and proposes a method for debugging programs in computer systems. Author (TAB)

N70-14197*# Arizona State Univ., Tempe. Engineering Research Center.
GERT SIMULATION PROGRAM 2 (GERTS 2)
A. Alan, B. Pritsker, and Philip C. Ishmaez Jan. 1969 95 p refs
(Contract NAS12-2035)
(NASA-CR-86285) Avail: CFSTI CSCL 09B

The procedures for using a digital computer program for simulating GERT networks are described. New and advanced concepts of GERT are introduced. The results obtained from the GERT simulation program are: (1) the probability that a node is realized; (2) the average, standard deviation, minimum and maximum time to realize a node; (3) a histogram of the times to realize a node; and (4) the average, standard deviation, minimum, and maximum counts observed during the time to realize a node. The GERT simulation program is written in FORTRAN IV using the concepts employed in GASP IIA. The program has been exercised on the IBM 1800 and GE 425 computers. The IBM 1800 has a FORTRAN IV operation set more restrictive than the general FORTRAN IV operation set. Therefore, the GERT simulation program can be used on most computers which have FORTRAN IV compilers. GERT networks with up to 1000 nodes can be simulated. Six illustrations of the use of the program are included along with a FORTRAN listing of all subprograms. Author

N70-14224*# Operations Research, Inc., Silver Spring, Md.
INFORMATION PROCESSING SIMULATION FOR EARTH APPLICATIONS SATELLITES Quarterly Technical Report
Patrick J. Steen and John E. Thomas, Jr. 15 Oct. 1969 90 p refs
(Contract NAS12-2110)
(NASA-CR-86274; TR-566; QTR-2) Avail: CFSTI CSCL 09B

Progress is reported in the areas of: the overall simulation concept, time-in-visual-view model, earth model and scenario tape, extension of radiometer sensor characterization, and spacecraft data processing model. A computer subprogram was derived to determine a schedule of satellite visual time in view. Flow charts were prepared for processing function subprograms within the spacecraft data processing model. Author

N70-14238# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
A FERRITE-DIODE CONTROL MACHINE FOR AUTOMATIC TRACKING SYSTEMS
Yu. B. Arkhangelskii, V. N. Kiselev, S. V. Korotkov, V. I. Mikhailychev, and V. A. Myasnikov 14 Feb. 1969 42 p refs Transl. from Tsifrovye Sistemy Upravleniya Tochnym I Mekhanizmami, (Leningrad), 1967 p 147–174
(AD-694768; FTD-MT-24-424-68) Avail: CFSTI CSCL 9/2

A machine designed for use in automatic control systems and for solving a broad class of mathematically formulated problems in navigation, geodesy, and astronomy is described. The digital control machine can be used independently as a computer or as a computing and controlling unit in a system which automatically controls objects or processes. The computing arrangement in the machine is of series action. The digital matrix has 25 binary units. From the standpoint of command structure the machine is a two-address system. The operating principle of the machine is described including the 16 operations which it performs. A block diagram of the entire system is presented and discussed. The following individual units are described in detail and associated block and circuit diagrams are also presented: control unit, arithmetical unit, storage system, magnetic working memory system, input-output device, control panel, and power supply unit. TAB

N70-14288# Air Force Systems Command, Wright-Patterson AFB, Ohio.
SPECIAL PURPOSE DIGITAL COMPUTER FOR INFORMATION
V. K. Vakhabov, I. K. Sheremet'yev, E. P. Kir'yanov and A. M. Mironov 10 Apr. 1969 13 p refs Transl. into ENGLISH from Vsesoyuznaya Konf. Po Inform. Poiskovym Sistemam I Avponvatizirovannoy Obrabotke Nauchno-Tekhn. Inform. 3d (Moscow), 1966, 1967 p 87–91
(AD-695195; FTD-MT-24-104-69) Avail: CFSTI CSCL 9/2

A special-purpose digital computer designed for information search as a part of a computerized information storage and retrieval system is described. The computer does not require an internal memory since intermediate translation and search results are recorded on a number of tracks of magnetic drums. The storage capacity of the drums is large enough to permit storage of at least one of the subsections of the data base; punched and magnetic tape are used for storing the search index and the vocabulary of the remaining subsections. The computer performs the following functions: translates queries from natural to descriptive language, searches for the address codes of relevant documents, and transfers information from punched tape and magnetic tape. TAB

N70-14290*# Arizona State Univ., Tempe. Engineering Research Center.
AN ANALYSIS OF A MANUFACTURING PROCESS USING THE GERT APPROACH
William J. Thompson, F. Stan Settles, and A. Alan B. Pritsker [1969] 30 p refs
(Contract NAS12-2035)
(NASA-CR-86289) Avail: CFSTI CSCL 09B

The Graphical Evaluation and Review Technique (GERT) Approach was used to analyze a manufacturing process which was causing production problems. The analysis begins at the point where the problem is recognized and progresses to a solution by applying the steps of the GERT Approach. The network formulation and data collection steps of the GERT Approach were emphasized. A detailed description was given of how to convert a physical manufacturing process into a GERT network form. The form of the branch parameters were developed from written descriptions of the operations represented by each branch. The importance of the data collection phase of the analysis was stressed. As part of the review process, three alternatives were proposed and evaluated by means of an improvement analysis. In addition it was shown how to expand the basic model to include greater detail including the incorporation of costs as random variables. See N70-14291. Author

N70-14291*# Arizona State Univ., Tempe. Engineering Research Center.

ON NETWORK MODELING OF MANUFACTURING AND RELATED PROCESSES USING GERT Summary Report

A. Alan B. Pritsker, Ronald A. Enlow, David J. Gallagher, Phillip C. Ishmael, and William J. Thompson [1969] 18 p refs (Contract NAS12-2035)

(NASA-CR-86283) Avail: CFSTI CSCL 09B

The application of the Graphical Evaluation and Review Technique (GERT) to analysis and improvement of a manufacturing process has been previously reported. GERT was used to study a generic area that involved the conceptualization of the process of planning in the form of a GERT network. For the GERT network description developed, the GERT computer programs were used to obtain results that illustrate a procedure for selecting between two suggested structures for a R and D process. The efficiency of the GERT simulation program was improved by introducing three new concepts: (1) new node and branch characteristics; (2) modifications to the network depending on the activities completed; and (3)incorporation of counting mechanisms. The new simulation program, GERTS 2, provides new capabilities in logical operations, information processing, and non-Markovian analysis. For related information see N70-14290. R.B.

N70-14327# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A GENERAL-PURPOSE, INTEGRATED DEVICE USING MAGNETIC CARDS: THE UKMK

Ya. R. Chernyak et al 10 Jul. 1969 11 p refs Transl. into ENGLISH from Seminar Tekhnol. Sredstua Sistem Obrabotki Dannykh, Upr. i Izmereniya (Moscow), no. 1, 1967 p 70–79

(AD-694822; FTD-MT-24-137-69) Avail: CFSTI CSCL 9/2

A general-purpose, integrated device using magnetic cards has been constructed which embodies a buffer storage unit, utilizing the magnetic drum principle, and a pointer input-output unit. TAB

N70-14336# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE SIRIUS SYSTEM OF INTERPRETATION AND RECOGNITION OF IMAGES AND ESTABLISHMENT OF CORRESPONDENCE

V. P. Romanov 3 Apr. 1969 27 p refs Transl. into ENGLISH from the Russian

(AD-694903; FTD-HT-24-55-69) Avail: CFSTI CSCL 9/2

The preliminary results of the modeling of the SIRIUS system, which replies to interrogation by images, are given. It is assumed that the images are two-dimensional, that they may in general be drawings, sketches, or photographs, and that the interrogation is put in the Russian language. The essential characteristic of the SIRIS system is that an image rather than a document is subjected to the process of information treatment. A listing of various papers dealing with systems which answer questions and analyze complex images as well as systems capable of solving problems in logic and arithmetic is given. The SIRIUS system of interpretation, recognition, and establishment of comparisons between images and verbal expressions is an operating system whose program is composed on the Ural-4 computer. The three elementary principles on which the systems operation is based are given. A general description of the system as a whole is presented. Samples of the linguistic part of the program, the questions put to the system and its replies concerning the image, are offered. TAB

N70-14338# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SYNTHESIS OF CODING DEVICES FOR CYCLIC CORRECTING CODES

E. A. Gurvits 30 Jan. 1969 35 p refs Transl. into ENGLISH from the Russian

(AD-694964; FTD-HT-23-878-68) Avail: CFSTI CSCL 9/4

A certain class of finite automata for the generation of cyclic correcting codes is considered. The expressions for the minimum number of elements are obtained, the design procedure is given, and corresponding configurations are reported. The paper deals with the problems of generating Bouz-Choudkhuri cyclic codes. TAB

N70-14349# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME PROBLEMS IN USING MULTIFREQUENCY ELEMENTS FOR EXCHANGING DIGITAL INFORMATION

K. G. Knorre et al 10 Apr. 1969 8 p refs Transl. into ENGLISH from the book "Mnogoznachnye Elementy i Struktury" Moscow, Izd-Vo, 1967 p 189–193

(AD-694753; FTD-HT-23-1265-68) Avail: CFSTI CSCL 17/2

At present, video-pulse channels are used for interconnecting digital computers for purposes of joint operation; data transmission is performed by a parallel code, which requires the number of channels and switching elements equal to the number of digits in the data. The potentialities of a multifrequency information-coding system are considered; this system would have the following advantages: (1) Simultaneous transmission of all digits over one line; (2) Address and digit selections can be performed by passive filters; (3) One logic element can process and store all digits of the number in question. TAB

N70-14390# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN AUTOMATIC DATA PROCESSING SYSTEM FOR IONOSPHERIC RESEARCH

E. K. Afraimovich et al 30 Apr. 1969 28 p refs Transl. into ENGLISH from Geofiz. Byul. (Moscow), no. 19, 1968 p 45–58

(AD-694782; FTD-MT-24-62-69) Avail: CFSTI CSCL 4/1

The Ionosphere Sector of the Kazakh Academy of Sciences has developed a computerized system of recording and reducing ionospheric data obtained through the use of radiosondes. SOD-A is the automatic multichannel system for the recording and reduction of data pertaining to the inhomogeneous structure of the ionosphere; SOD-B is the installation for the reduction of vertical panoramic sounding data (semiautomatic input of data directly into computer); SOD-C is the installation for the recording of panoramic vertical sounding data in the transitional stage storage unit; SOD-D is the system for the recording and reduction of data obtained in investigating radiowave propagation; SOD-E is the system for the recording and reduction of data obtained in investigating the height (frequency) relationships of the basic parameters characterizing the state of the ionosphere. Author (TAB)

N70-14395# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A DESIGN ANALYSIS OF ELECTRON OPTICAL DEVICES FOR INFORMATION PROCESSING

V. I. Alekhin 9 Dec. 1968 8 p refs Transl. into ENGLISH from Prib. i Sist. Avtomatiki (USSR), no. 5, 1967 p 137–140
(AD-694790; FTD-HT-23-1174-68) Avail: CFSTI CSCL 9/2

The use of photographic plates for recording computer outputs and for data input is discussed. This method is advantageous because of the high storage density (10,000 to 1,000,000 information channels per square centimeter) it yields. The limiting factor in storage density is the spot size of the recording and scanning cathode ray tube and ultimately, the graininess of the photographic emulsion. The recording in binary form can be made either by individual points as their coordinates become available from the computer, or in blocks. The recording speed is determined by both the computer and the emulsion. Flying spot scanners are used to transfer the data from a photographic plate to the computer. TAB

N70-14409*# Arizona State Univ., Tempe. Engineering Research Center.

PLANNING R AND D PROJECTS USING GERT

Ronald A. Enlow and A. Alan B. Pritsker Jun. 1969 76 p refs
(Contract NAS12-2035)
(NASA-CR-86278) Avail: CFSTI CSCL 09B

This study investigates the use of GERT in describing and analyzing the planning of research and development projects. Research and development programs are characterized by logical building blocks which are used to describe the underlying structure of the planning process. Five milestones are defined: problem definition, completion of the research activity, completion of the evaluation of proposed solutions, completion of a prototype, and implementation of the solution. The activities equivalent to these milestones are described as the fundamental processes of creative thought, time estimation, cost estimation and evaluation. Utilizing these descriptive tools, the R & D effort is analyzed with respect to the logical relationships between activities and the alternate paths by which the milestones may be realized. This information is then drawn in network form. A computer program is available to simulate the network and examples are presented. The ability of GERT to provide information on which the choice of alternate R & D structures can be based is indicated and the problem of projecting completion times, probability of success and man-hour requirements is considered. Author

N70-14469# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ALGORITHMS AND ALGORITHMIC LANGUAGES

V. M. Veselov et al 12 May 1969 32 p refs Transl. into ENGLISH from Dokl. Fiz.-Energ. Inst. (Obninsk, USSR), no. 81, 1967 p 1–27
(AD-695921; FTD-MT-24-498-68) Avail: CFSTI CSCL 9/2

This paper is intended as an introduction to a number of problems connected with the description of algorithms and algorithmic languages, particularly the syntaxes and semantics of algorithmic languages. The terms letter, word, alphabet are defined and described. The concept of the algorithm is defined and the relation between the algorithm and the alphabet is explained. Normal algorithms and the process of normalization are described. The relation between the algorithm, as a computational process, and the algorithmic language, which is a means of coding the meaning of the process, is explained. Problems involved in the description of the algorithmic language and its translation into other languages (machine language, natural language, meta-language) are then described and the several methods for defining syntactic concepts proposed in the literature are reviewed. TAB

N70-14477# Illinois Univ., Urbana. Coordinated Science Lab.

ON A ROOT-DISTANCE RELATION FOR ARITHMETIC CODES

Robert T. Chien and Se June Hong Oct. 1969 18 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-2339)
(AD-695951; CSL-R-440) Avail: CFSTI CSCL 9/4

It is shown that, for all practical purposes, one can synthesize codes of given length and minimum distance by a simple root-distance relation. This gives the strong relation between the arithmetic code and the BCH code. TAB

N70-14478*# Arizona Univ., Tucson. Dept. of Electrical Engineering.

ANLYZ: A DIGITAL COMPUTER PROGRAM FOR THE COMPLEX ANALYSIS OF DISTRIBUTED-LUMPED-ACTIVE NETWORKS

L. P. Huelsman Oct. 1969 35 p refs
(Grant NGL-03-002-136)
(NASA-CR-107443) Avail: CFSTI CSCL 09B

This report describes ANLYZ, a digital computer program for the complex analysis of distributed-lumped-active networks. The program is designed to be used in complex optimization studies of a broad class of this type of network. The program provides as output the magnitude (or the reciprocal of the magnitude) of the voltage transfer function for the network as evaluated at a specific point in the complex frequency plane. The program is designed to be used with the GOSPEL optimization software package described in a previous report. Author

N70-14482*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DATA MANAGEMENT AT THE NATIONAL SPACE SCIENCE DATA CENTER

James I. Vette and Nick Karlow Dec. 1969 12 p refs Presented at AIAA Earth Resources Observations and Inform. Systems Meeting, Annapolis, 2–4 Mar. 1970
(NASA-TM-X-63777; X-601-69-528) Avail: CFSTI CSCL 09B

The primary function of the National Space Science Data Center (NSSDC) is to provide the means for the dissemination and analysis of space science data beyond that provided by the original experimenter. The Center is, therefore, not an operational data processing center. However, the recognition of important secondary uses of data generated for operational needs is vital. Since the requirements placed on operational centers to accommodate this secondary function are minimal, the experiences of NSSDC in the secondary uses of space science data will be discussed. With a present satellite generation rate of one trillion bits per year of space science information, the data management problems become significant, and considerable data processing is required before maximum utilization of the data base can be realized. In addition, the Data Center must be concerned with an information system to handle documentation, performance data, instrument calibrations and characteristics, and management information. Author

N70-14491# Air Force Systems Command, Wright-Patterson AFB, Ohio.

THE 'ARKUS' ELECTRONIC SELF-ADJUSTING MATHEMATICAL MACHINE

G. E. Pukhov et al 15 May 1969 8 p refs Transl. into ENGLISH from Mekhanizatsiya i Avtomatizatsi Ya Upravleniya (Moscow) no. 3, 1968 p 46–47
(AD-694178; FTD-MT-24-124-69) Avail: CFSTI CSCL 9/2

The Institute of Cybernetics of the Academy of Sciences UkrSSR has developed the Arkus hydrid computer. The machine is capable of solving systems of linear or nonlinear differential equations up to the 8th order with linear or nonlinear boundary conditions, with up to 8 nonlinearities in nonlinear differential equations and up to 6 nonlinear boundary conditions. For this

purpose the machine has 32 dc amplifiers, 8 nonlinearity elements, and 8 multipliers. The solution is sought in two iteration modes: (1) Initially, when the tentative solution is far from the desired, the method of the steepest descent is used and (2) Later, when the desired solution is more closely approached, the combinational Newton method is applied. TAB

N70-14528# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COMPUTING MEDIUM USING THRESHOLD ELEMENTS WITH COMBINED FUNCTIONS

L. I. Makarov 23 Apr. 1969 22 p refs Transl. into ENGLISH from Vychislitelnye Sistemy (USSR), no. 26, 1967 p 67–82

(AD-695949; FTD-MT-24-107-69) Avail: CFSTI CSCL 9/2

The realizability of a computing medium (i.e., a homogeneous logic structure whose function may be controlled on command), in which logic and coupling functions are performed jointly, is discussed. Certain logic functions are performed by interaction of a group of computing medium elements. Two variants based on pulsed and dc level signals are presented. They differ in the number of bits which are necessary for changing the structure and, therefore, the function of the elements. For the two cases cited, these quantities are equal to 1 and 5, respectively. The aim of this study is to reduce the number of information bits necessary for control of computing medium elements over that when each element has independent control. This is done by grouping a number of elements to perform the desired functions. In the pulsed threshold system, a refractory period exists when the elements do not react to input signals. Signal transmission and branching are illustrated for this system as well as methods of realizing two-input conjunction, disjunction, storage, and interaction. The level threshold elements, on the other hand do not have a refractory property but nevertheless they are able to perform signal branching, NOR operation, negation, and storage. Author (TAB)

N70-14548# Air Force Systems Command, Wright-Patterson, AFB, Ohio. Foreign Technology Div.

A SYSTEM FOR AUTOMATING ENGINEERING CALCULATIONS BASED ON THE MINSK-1 COMPUTER

N. G. Zaitsev 22 Apr. 1969 11 p Transl. into ENGLISH from Russian conf.

(AD-695194; FTD-MT-24-51-69) Avail: CFSTI CSCL 9/2

Design and operation of remote computer terminals for engineering computations, as well as a modification of ALGOL developed for this purpose, are described. The system provides for a very economical operation, such that even those with a relatively small volume of work should be able to afford it. The particular version described by the author is based on the utilization of the Minsk-1 computer. The remote terminals are equipped with teletype equipment that serves as input-output facility. The problem is transmitted by the user via teletype to the computing center, where it is punched out on paper tape, the mathematician on duty checks the tape for possible errors and transfers it to the computer operator who runs the problem. The results are sent via teletype to the user. The version of ALGOL which is utilized by the user is simple enough for any engineer, who need not be familiar with programming techniques. To reduce errors either repeated data transmission, or parity check can be used. The author describes the remote terminal and the operational language in some detail. TAB

N70-14571*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

DIFFERENTIAL DYNAMIC PROGRAMMING METHOD FOR BANG-BANG CONTROL PROBLEMS: ALGORITHMS AND ERROR ANALYSIS

David Harris Jacobson Oct. 1969 20 p refs

(Grant NGR-22-007-068; Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0005; N00014-67-A-0298-0008)

(NASA-CR-107446; TR-598) Avail: CFSTI CSCL 09B

Differential dynamic programming is a technique, based on dynamic programming rather than the calculus of variations, for determining the optimal control function of a nonlinear system. Differential dynamic programming applies the principle of optimality in the neighborhood of a nominal, possibly nonoptimal, trajectory. This allows the coefficients of a linear or quadratic expansion of the cost function to be computed in reverse time along the trajectory; these coefficients may then be used to yield a new improved trajectory. A class of nonlinear control problems, linear in the control variables, is studied using differential dynamic programming. New second and first order algorithms for determining the optimal bang-bang control by successively improving a nominal guessed control function are devised. Author

N70-14581# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

INCREMENTAL METHODS FOR COMPUTER GRAPHICS

Dan Cohen Apr. 1969 115 p refs

(Contract F19628-68-C-0379)

(AD-694550; ESD-TR-69-193) Avail: CFSTI CSCL 9/2

This report is concerned with incremental methods for computer graphics. The application of the incremental approach to some advanced problems in computer graphics is discussed and demonstrated. In Section II, the problem of fast curve generation and display is discussed. This section uses the mathematical approach to curves as a perspective projection of polynomial-curves in higher-dimensional spaces. Section III, also discusses a fast generation of curves, but using another mathematical approach, the linear-differences method, only two-dimensional curves are discussed. Section IV, shows how to make the Warnock algorithm, for hidden lines elimination, incremental. Section V, discusses the generation of half-tone images, in real time. Section VI, discusses an incremental method for finding the intersection of given line segments. Author (TAB)

N70-14594# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COMPUTER SYSTEMS: WORK COMPILATION (SELECTED ARTICLES)

B. M. Kurilov et al 30 Jan. 1969 39 p refs Transl. into ENGLISH from Sb. Tr. Akad. Nauk SSR, Sibirskoye Otdeleniye, Inst. Mat., Vychislitelnyye Sistemy (USSR), no. 22, 1966 p 21–37, 59–76

(AD-695882; FTD-HT-23-880-68) Avail: CFSTI CSCL 9/2

Contents: Obtaining sufficient characteristics in pattern recognition; The alphabet of objects of recognition. TAB

N70-14604# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

VERBAL INPUT OF A SET OF COMMANDS INTO THE BESM-3M HIGH SPEED ELECTRIC COMPUTER

G. Ya. Vysotskii 24 Apr. 1969 11 p refs Transl. into ENGLISH from Tr. Akad. Nauk SSSR, Vychislitelny Tsenter, Raboty po Tekh. Kibernetike (Moscow), no. 1, 1967 p 52–59

(AD-694846; FTD-HT-23-960-68) Avail: CFSTI CSCL 9/2

Up to 50 instructions may be entered aurally into the BESM-3M digital computer by an arbitrary speaker in a room with noisy background with the aid of a speech recognition system which operates on signals divided into voice spectrum sub-bands and clipped speech parameters. In this system channel number 1 passes speech energy which exceeds a certain threshold value and which occupies a band below 500 Hz; channel number 2 reacts to signals whose frequencies are above 500 Hz. Other channels (consisting of bandpass filters) are used for distinguishing vowel sounds. Thus, channel number 5 recognizes a and e and partially e and u sounds and channel number 6 may distinguish i and y and partially u sounds. The resulting pulses are counted, an action

which identifies affricates and fricatives with sufficient accuracy. The resulting speech indices, coded in binary form, are interrogated by the BESM-3M computer input unit at a rate of 100 Hz. This information is subsequently stored in the BESM-3M main memory. It takes up to 1 sec to enter an aural command into the computer. All aural signals may be delivered to an octal output printer whose output makes it possible to study word structure and individual sounds. TAB

N70-14624*# Mathematical Applications Group, Inc., White Plains, N.Y.

DESCRIPTION OF THE VIP PROGRAM FOR COMPUTING INCIDENT AND ABSORBED ENERGY AT THE SURFACE OF AN ORBITING SATELLITE

R. Goldstein and R. Nagel Mar. 1969 94 p

(Contract NAS5-11702)

(NASA-CR-107307) Avail: CFSTI CSCL 09B

The Vehicle Illumination Program(VIP), a FORTRAN 4 code for determining incident and absorbed radiant energy on the surface of orbiting space vehicles, was written to provide a wide range of flexibility in problem solving. The code treats external energy sources from the sun, an arbitrary planet, and planetary reflection of sunlight, along with energy absorption and reflection on satellite surfaces. Inertial, spin-stabilized, and gravity gradient orbit classifications are briefly discussed. A users guide is provided for VIP calculations. The program uses a combinatorial geometry technique for modeling three dimensional geometries and inputting the model into a computer. A qualitative description of each subroutine is given, as well as mathematical formulations of some of the more important routines. J.A.M.

N70-14630# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE MIKS COMPILING SYSTEM FOR USING STANDARD ROUTINE LIBRARY FOR THE MINSK-2 COMPUTER

P. Kh. Byrnev et al 15 Jul. 1969 7 p refs Transl. into ENGLISH from Prace Inst. Maszyn Mat., PAN (Warsaw), v. 4, no. 7, 1967 p 131–134

(AD-695943; FTD-MT-24-165-69) Avail: CFSTI CSCL 9/2

A description is given of a compiling-interpreting system which is designed to use a library of standard subroutines. TAB

N70-14631# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROBLEM OF THE DIAGNOSTIC TESTING OF DIGITAL COMPUTERS

I. V. Kogan 22 Apr. 1969 11 p ref Transl. into ENGLISH from Tsifrovaya Vychislelnaya Tekhn. i Programirovaniye (USSR), no. 2, 1967 p 66–69

(AD-694152; FTD-HT-23-1268-68) Avail: CFSTI CSCL 9/2

As the combination circuits used in digital computers can be regarded as single-cycle automata, a method of setting up tests for determining failures in such automata is suggested. The problem consists of these two parts: (a) description of the automaton by a formula suitable for setting up the test and (b) constructing the test according to the formula. It is assumed that some intermediate inputs and outputs in the automaton take on permanent one or zero values as a result of internal failures in logic cells. Most modern automata consist of standard cells performing the operations of conjunction, disjunction, and negation. TAB

N70-14714# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CONTROLLING CALCULATION-MACHINE OPERATION

D. D. Savostyanov 30 Jan. 1969 30 p Transl. into ENGLISH from the Pub. "Konstruktsiya i Remont Vychislitelnykh Mashin" Moscow, Izd. Statistika, 1966 p 5–20

(AD-694923; FTD-HT-23-907-68) Avail: CFSTI CSCL 9/2

The document gives general information on the indicated machine models, and it describes the procedure used to prepare them for operation, to control machine operation in execution of arithmetic operations, and the procedure employed to check the calculation. The mechanic requires such knowledge so that he can properly and completely test machine operation and detect all malfunctions before the repair operation begins, and then check the results of his work after repairs are completed. TAB

N70-14715# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ANALYSIS OF THE CRYOTRONIC ASSOCIATIVE ELEMENT CONTROLLED BY MONOPOLAR CURRENTS

I. D. Voitovich 5 May 1969 15 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSR, Inst. Kivernetiki, Seminar po Fiz.-Tekhnol. Vopr. Kibernetiki, Dokl. (Kiev), 1967 p 79–87

(AD-695318; FTD-HT-23-942-68) Avail: CFSTI CSCL 9/2

An analysis is given of the associative memory element designed by I. D. Voytovich (Assotsiativnyy zapominayushchiy element. The analysis of the element includes consideration of: the gate threshhold current; the network critical current; the amplification coefficient; the coefficient of rectangularity of the transfer curve, and the relative deviation from the mean values of inductivity of the branches of the memory edge. TAB

N70-14751# Argonne National Lab., Ill.

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON ADVANCED DATA PROCESSING FOR BUBBLE AND SPARK CHAMBERS

Richard J. Royston, ed. Jan. 1969 527 p refs Conf. held at Argonne, Ill., 28-30 Oct. 1968

(Contract W-31-109-eng-38)

(ANL-7515) Avail: CFSTI

Conference papers are presented on computers and auxiliary equipment, on-line operation, pattern recognition, and ionization and bubble density measurements. For individual titles see N70-14752 to N70-14793.

N70-14765# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).

PRESENTATION OF BRUSH. PART 1: BRUSH: AN ECONOMICAL SPECIAL-PURPOSE COMPUTER FOR ON-LINE HPD DATA PROCESSING, TRACK RECOGNITION AND TRACK FOLLOWING

H. Billing, A. Ruediger, and R. Schilling *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 48–62 (See N70-14751 04-08)

Avail: CFSTI

In this first of two papers on BRUSH, the overall concept is discussed. Details on hardware realization and on the simulation results are given in the BRUSH status report following this paper. A hardware solution to zero (or minimum) guidance on-line track recognition is proposed. The task of detecting track element candidates (in slices of 16 scan lines each) is solved by a two parameter histogram technique. This is implemented by an array of 16 parallel shift register chains and 48 local processing units. Acceptance of track elements is made subject to certain confidence criteria. Accepted track elements are linked to form curved tracks. These allow tracks following into the next slice along narrow curved roads, and also a review into past slices to pick up track elements that may have been missed. The track element data, including bubble distribution, linkage information and confidence values are stored on tape for further processing in a special 3D geometry program. Author (NSA)

N70-14758# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
PRESENTATION OF BRUSH. PART 2: STATUS OF THE BRUSH SYSTEM: HARDWARE REALIZATION AND SIMULATION RESULTS
H. Billing, A. Ruediger, and R. Schilling *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 63–80 (See N70-14751 04-08)
Avail: CFSTI

The rather severe real time requirements of the BRUSH system are met by distributed local processing units, by a fast central processing unit and by a program stored in a read-only diode matrix. The crucial hardware parts of the system have been tested successfully. The feasibility of the BRUSH concept has been tested extensively and successfully on a general purpose computer. These simulations allowed an estimation of different search and discrimination strategies with respect to their efficiency in both recognition yield and CPU time. Yield and accuracy of track recognition are demonstrated by simulation results. Limitations of the system will be discussed. A special geometry program will have to be written to deal with the BRUSH output. Certain measures can be taken to relieve this geometry program of unnecessary reconstruction of beam tracks. Author (NSA)

N70-14759# Wisconsin Univ., Madison. High Energy Physics Dept.
TRACK FOLLOWING WITH SATR
E. Morse *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 102–119 (See N70-14751 04-08)
Avail: CFSTI

The most important part of SATR is the three-dimensional pattern recognition system. This is a hardware device which is being constructed at the University of Wisconsin. The use of SATR hardware simulation programs is discussed and some of the problems and solutions encountered when following bubble chamber tracks in three dimensions are discussed. (NSA)

N70-14761# Istituto Nazionale di fisica Nucleare, Bologna (Italy). Centro Nazionale Analisi Fotogrammi.
THE NEW FSD-IBM 360/44 SYSTEM REALIZED AT CNAF AND ITS PERFORMANCES BOTH WITH ROAD AND MINIMUM GUIDANCE
M. A. Di Lazzaro, M. L. Luvisetto, A. Maggiolo, M. Masetti, A. Mignoli et al *In* Argonne Natl. Lab. Proc. of the Intern Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 140–163 refs (See N70-14751 04-08)
Avail: CFSTI

The work at CNAF to analyze bubble chamber events by use of the FSD system is described. The actual work consists of three main items based upon our experience with the FSD-IBM 7094 system (analysed experiment and ionization measurements). The first is the new FSD-IBM 360/44 system and its performance with road guidance programs. The second is analysis of events essentially using minimum guidance programs written for the FSD-IBM 360/44 system. The third is the application of the minimum guidance philosophy to the usual track following with road guidance programs. Author (NSA)

N70-14762# Amsterdam Univ. (Netherlands). Zeeman-Lab.
THE HPD-CDC 3200 SYSTEM AT AMSTERDAM
M. de Boer, P. H. A. van Dam, D. Harting, D. J. Holthuizen, W. M. van Leeuwen et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 164–172 (See N70-14751 04-08)
Avail: CFSTI

The digitizing method, the hardware, and the software of the HPD-CDC 3200 system for analysis of bubble chamber film at Amsterdam are discussed. NSA

N70-14763# California Univ., Berkeley. Lawrence Radiation Lab.
THE COBWEB DATA REDUCTION SYSTEM
Herbert C. Albrecht, Eugent P. Binall, Robert W. Birge, Myron H. Myers, and P. Wes Weber *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 173–183 refs Sponsored by AEC (See N70-14751 04-08)
Avail: CFSTI

The Cobweb data reduction system, which is an on-line computer-controlled data analysis system designed to improve and increase the measuring rate of conventional track following Franckensteins and also to include checks on the output from scan tables, is described. NSA

N70-14764# Brookhaven National Lab., Upton, N.Y. Dept. of Physics.
A DATA TERMINAL NETWORK WITH ACCESS TO A LARGE COMPUTER COMPLEX
B. B. Culwick, E. Glazer, D. V. Hirst, and T. C. Meehan *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 184–193 ref Sponsored by AEC (See N70-14751 04-08)
Avail: CFSTI

The design objective of this network is to provide a convenient means of access to a central computer in the laboratory. In addition to access to the central computer, remote terminals are partially serviced by a satellite computer which handles the scheduling of resources. Remote terminals consist of a teletype, a relatively powerful CRT display, and a 'track-ball' which serves the pointing function of the CRT screen. R.B.

N70-14765# Brookhaven National Lab., Upton, N.Y. Dept. of Physics.
THE ROLE OF HUMAN GUIDANCE IN A FAST MEASUREMENT SYSTEM
P. L. Connolly, W. C. Delaney, P. V. C. Hough, J. M. Howie, R. R. Kinsey et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 194–201 Sponsored by AEC (See N70-14751 04-08)
Avail: CFSTI

The use of a Sigma 7 computer for control and editing of original measurements and for display and editing of final results is discussed. The importance of human control in the scanning system is stressed, although human control can be reduced as the system programs become more powerful. The critical questions of the frequency and time required for the scanner to fix up an event are not answered due to the small number of events analyzed by the system. R.B.

N70-14767# California Univ., Berkeley. Lawrence Radiation Lab.
OPERATIONS ON-LINE TO A LARGE COMPUTER
Carol Osborne *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 226–232 refs (See N70-14751 04-08)
Avail: CFSTI

The TRIST multiprogramming system which was designed to coordinate computer use between the real time Flying Spot Digitizer (FSD) programs and other data analysis programs is described. NSA

N70-14768# Argonne National Lab., Ill.
TRACK FINDING, FOLLOWING, AND EVENT

RECOGNITION ON POLLY
J. G. Loken and W. W. M. Allison *In its* Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 244–255 (See N70-14751 04-08)
Avail: CFSTI

Recent experience with the POLLY device which is basically an operator helped or operator linked system for analysis of bubble chamber film is discussed. NSA

N70-14772# California Univ., Berkeley. Lawrence Radiation Lab.
DAPR: DIGITAL PATTERN RECOGNITION APPROACHES PRODUCTION
Howard S. White, Barbara Britton, Joan Franz, Wen-Sue Gee, Dennis Hall et al *In* Argonne Natl. Lab. Proc. of The Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 275–298 refs Sponsored by AEC (See N70-14751 04-08)
Avail: CFSTI

DAPR is a system which has been developed for digital automatic pattern recognition in bubble chamber pictures. Pictures are measured by the Flying Spot Digitizer, and the data are reduced to yield a data abstract tape. This tape has, for each track found within each picture, precision points representing its locus, and a measurement of bubble density. The tape also has a short table specifying the spatial vertices and their constituent tracks in the three views. The data abstract tape may be rapidly scanned by a computer program; this program, without manual assistance or further reference to the film, yields an output tape containing selected events edited into a format suitable for processing by a standard geometry program. The comparison of DAPR and manual scanning is very encouraging. While certain additions are needed to the degree of sophistication in parts of the system's logic, these are few in number and clear in concept. Author (NSA)

N70-14774# California Univ., Berkeley. Lawrence Radiation Lab.
AUTOMATIC SCAN
Joan Franz *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 306–309 ref (See N70-14751 04-08)
Avail: CFSTI

The automatic scan program is a C-level 7094 program which reads a data abstract tape and selects events, assigns event types and edits data onto magnetic tapes in the standard HAZE format. The data abstract tape, which is a result of A and B-level DAPR program operation, contains track coordinates for each view and a list of tracks associated with each spacial vertex. In selecting events, straightforward programming techniques are applied to impose physics selection criteria upon the data. The program outputs a DAPR scan report which lists the selected events by frame and vertex location. If a manual pre-scan tape is also input, the DAPR scan report will list pre-scan comparisons. The method by which the program selects events from the data abstract tape is described. Author

N70-14776# European Organization for Nuclear Research. Geneva (Switzerland).
PATTERN RECOGNITION FOR WIRE CHAMBER EXPERIMENTS
S. J. W. Evans, H. Grote, M. B. Metcalf, J. D. Wilson, and P. Zanella *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 317–327 refs (See N70-14751 04-08)
Avail: CFSTI

The programming methods used at CERN for the pattern recognition of events recorded by wire spark chambers are outlined. The methods of event reconstruction from spark coordinates have been used, as far as possible, on the techniques used with visual spark chambers, but it has been necessary to devise new techniques in several cases. The description of these new methods and the reasons for using them are examined. NSA

N70-14780# Brookhaven National Lab., Upton, N.Y. Dept. of Physics.
USE OF FSD BUBBLE DENSITY MEASUREMENTS FOR THREE BNL BUBBLE CHAMBER GROUP 80-INCH CHAMBER EXPERIMENTS
R. C. Strand, D. J. Crennell, W. E. Ellis, and I. O. Skillicorn *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 362–370 refs Sponsored by AEC (See N70-14751 04-08)
Avail: CFSTI

The savings of manual effort and computer time in three recent experiments from the 35 mm Mark 1 and 70 mm Mark 2 digitizers are reported. The role of density measurements in bubble chamber experiments is reviewed and the history of FSD density measurements at Brookhaven National Laboratory is discussed. R.B.

N70-14786# California Univ., Berkeley. Lawrence Radiation Lab.
FSD HARDWARE MONITORING
Loren Shalz *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 398–400 (See N70-14751 04-08)
Avail: CFSTI

The digital output of the FSD consists of stage positions, track center values and a full grating count. The stage positions and the most significant digits of the track centers are from a direct readout from gratings. The five least significant digits of the track centers are from interpolation counters. A special test pattern is used for calibration and track center detector monitoring. The test pattern is an array of fiducials plus a set of 7 parallel lines and 7 converging lines for each mode of measuring. Track center is determined by integrating to find center of area. This method is relatively insensitive to fluctuations in the shape of the input signal. The integrators are checked by studying repeated digitizings, with the stage stopped, of the same point on each of the parallel lines on the test frame. The calibration program determines the coefficients in the transformations which relate normal and orthogonal modes by means of a common orthogonal coordinate system in microns. The transformations are assumed linear and consist of a shear, translation, and magnification. R.B.

N70-14788# Pennsylvania Univ., Philadelphia. Dept. of Physics.
PATTERN RECOGNITION OF FOUR PRONG EVENTS
R. O'Donnell, E. Bogart, S. Hagopian, V. Hagopian, W. Ko et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 412–420 (See N70-14751 04-08)
(Contract AT(30-1)-2171)
Avail: CFSTI

The purpose of Phase 3 of the minimum guidance system of the University of Pennsylvania for processional bubble chamber film digitized on a HPD is shown to be pattern recognition in four prong events. The performance of the HPD and all associated software was tested by first checking the accuracy and efficiency in measuring a sample of 127 events which were previously conventionally measured and processed through THRESH-GRIND. NSA

N70-14799# Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERTAIN PROBLEMS OF CONTROL OF TERRITORIAL DATA: TRANSMISSION AND PROCESSING NETWORKS
I. A. Bashmakov 4 Feb. 1969 11 p refs Transl. into ENGLISH from Trans. Symp. on Computer Systems, Novosibirsk, (USSR).

1967 p 63–71 Symp. held at Novosibirsk, USSR, 1966
(AD-695223; FTD-HT-23-879-68) Avail: CFSTI CSCL 17/2

The problems involved in a decentralized control of territorial information-and-computing networks are considered in general terms. The control is supposed to solve the following problems (A) controlling the flow of information through the network (See Figure) (B) encoding, decoding, and other processing of information (C) automatic monitoring of network operation. Author (TAB)

N70-14804# Syracuse Univ. Research Inst., N.Y.
THEORY OF ADAPTIVE MECHANISMS. VOLUME 2: SELECTED TOPICS IN AUTOMATA THEORY
V. C. Hamacher, G. G. Langdon, and R. G. Cantarella Nov. 1968 147 p refs
(Contract F30602-67-C-0011)
(AD-680793; RADC-TR-68-388) Avail: CFSTI CSCL 9/2

CONTENTS:

1. LANGUAGES BETWEEN CONTEXT-FREE AND CONTEXT-SENSITIVE V. C. Hamacher p 1–19 refs (See N70-14805 04-08)

2. ANALYSIS OF ASYNCHRONOUS CIRCUITS UNDER DIFFERENT DELAY ASSUMPTIONS G. G. Langdon, Jr. p 20–50 refs (See N70-14806 04-08)

3. DELAY-FREE ASYNCHRONOUS CIRCUITS WITH CONSTRAINED LINE DELAYS G. G. Langdon, Jr. p 51–65 refs (See N70-14807 04-08)

4. SOME TOPICS IN THE SYNTHESIS OF ASYNCHRONOUS CIRCUITS G. G. Langdon, Jr. p 66–76 refs (See N70-14808 04-08)

5. ALGORITHMIC THEOREM PROVING R. G. Cantarella p 77–134 refs (See N70-14809 04-19)

N70-14805# Syracuse Univ. Research Inst., N.Y.
LANGUAGES BETWEEN CONTEXT-FREE AND CONTEXT-SENSITIVE
V. C. Hamacher *In its* Theory of Adaptive Mech., vol. 2 Nov. 1968 p 1–19 refs (See N70-14804 04-08)
Avail: CFSTI

A simple extension of context-free grammar is presented which enables the generation of context-sensitive languages. Some notions from finite state machine theory aid in the visualization of the derivations and it is shown that all languages generated by grammars of the new class can be recognized by a deterministic linear bounded automata. Author

N70-14806# Syracuse Univ. Research Inst., N.Y.
ANALYSIS OF ASYNCHRONOUS CIRCUITS UNDER DIFFERENT DELAY ASSUMPTIONS
G. G. Langdon, Jr. *In its* Theory of Adaptive Mech., vol. 2 Nov. 1968 p 20–50 refs (See N70-14804 04-08)
Avail: CFSTI

Asynchronous circuits are analyzed from the standpoint of different constraints which may apply to the stray delays. The relationship between 'hazard-free' sequential networks and 'speed independent' circuits is illuminated. Speed independence is defined relative to a fundamental mole circuit (which may in turn be described by a flow table); the analysis is carried out from this standpoint and the allowed sequence graph may be used to detect critical races. A circuit is seen to be speed independent if and only if its circuit-derived excitation matrix has no 1-input change critical races. The generalization of the essential hazard has been studied in detail and is shown to be an obstacle to hazard-free realization when line delays can be arbitrarily large. Author

N70-14807# Syracuse Univ. Research Inst., N.Y.
DELAY-FREE ASYNCHRONOUS CIRCUITS WITH CONSTRAINED LINE DELAYS
G. G. Langdon, Jr. *In its* Theory of Adaptive Mech., vol. 2 Nov. 1968 p 51–65 refs (See N70-14804 04-08)
Avail: CFSTI

It has been shown how fundamental-mode normal flow tables can be realized without delay elements under the constraint that line delays do not exceed a given chain of gate delays. The state assignments for these tables are designed to yield noncritical races and minimum transition times. This report presents an independently discovered alternative to their design procedure and extends their results to totally sequential state assignments and to multiple-input change transitions. The almost totally sequential state assignment is defined and presented as an approach toward delay-free realizations, under suitable line delay constraints, of nonnormal flow tables. Author

N70-14808# Syracuse Univ. Research Inst., N.Y.
SOME TOPICS IN THE SYNTHESIS OF ASYNCHRONOUS CIRCUITS
G. G. Langdon, Jr. *In its* Theory of Adaptive Mech., Vol. 2 Nov. 1968 p 66–76 refs (See N70-14804 04-08)
Avail: CFSTI

A state assignment procedure intended for single-input change delay-free realizations of normal flow tables with no essential hazards is extended. The extension is valid for multiple-input change transitions and the unbounded delay assumption provided no transition involving the essential hazard is initiated. A procedure is also given for synthesis of normal flow tables under the bounded delay assumption. This procedure places no restrictions on the state assignment and is also valid for multiple-input changes. Author

N70-14819# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
INSTRUMENT MANUFACTURE, MEANS OF AUTOMATION, AND CONTROL SYSTEMS SELECTED ARTICLES
V. P. Antipenkov et al 14 Apr. 1969 21 p refs Transl. into ENGLISH from Moskovskaya Konf. Molodykh Uchenykh i Spetsyalistov 1st. (Russian), 1967 p 146–155
(AD-694882; FTD-HT-23-1212-68) Avail: CFSTI CSCL 13/8

Contents: A machine for centralized automatic supervision and control of aluminum production; and Simulation of PERT graphs on general-purpose analog computers. TAB

N70-14916# Michigan Univ., Ann Arbor. Logic of Computers Group.
A NOTE ON SERIES PARALLEL IRREDUCIBILITY
Bernard Phillip Zeigler Oct. 1969 11 p refs
(Contracts DA-31-124-ARO(D)-483; N00014-67-A-0181; Grant PHS-GM-12236)
(AD-695679; Rept-08226-14-T) Avail: CFSTI CSCL 9/2

A new criterion for series-parallel irreducibility is given which makes no reference to underlying semigroups but involves only series-parallel connection operations. Author (TAB)

N70-14973# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESEARCH AND DEVELOPMENT OF HIGH SPEED PROCESSOR ARRAYS Interim Report, 22 Jan.–21 Apr. 1969
Jun. 1969 22 p refs Prepared in cooperation with Philco-Ford Corp.
(Contract AF 19(628)-5167)
(AD-694555; ESD-TR-69-248; IR-3) Avail: CFSTI CSCL 9/5

Preliminary design for a processor master array chip containing 80 gates and 16 reference bias cells has been completed. Functioning read-only memory arrays were successfully fabricated. A flexible technique for programming these ROMs at the chip level has been developed and demonstrated. Speed-power studies aimed at obtaining optimum performance in the processor arrays are continuing. Yield improvement studies are continuing. This effort

includes the investigation of the applicability of the CDI process to high-speed ECL and the design of a complex multilevel process test chip for characterizing and monitoring multilevel interconnection processes and structures. Test vehicles are being fabricated for investigating face-down bonding and aluminum beam lead technologies. Reliability data are presented for high-speed two-level arrays. Author (TAB)

N70-14974# Computer Corp. of America, Cambridge, Mass.
AN EXPERIMENTAL COMPUTER NETWORK Final Report, 1 Jan. 1967 – 31 Mar. 1969
30 Mar. 1969 56 p refs Prepared for Lincoln Lab., Mass. Inst. of Tech.
(Contract AF 19(628)-5167; ARPA Order 691)
(AD-694055; ESD-TR-69-74) Avail: CFSTI CSCL 9/2

The concept of a computer network is reviewed. Within such a network, a user at any one installation has immediate access to the hardware, software, and data at all other installations. The various installations need not be program-compatible. The implementation of a small experimental network based on these concepts is discussed. The details of the implementation and the experience gained in the operation of this experimental network are described. Author (TAB)

N70-15036# Florida State Univ., Tallahassee. Computer-Assisted Instruction Center.
THE DATA WORLD OF CAI
Duncan N. Hansen and Walter Dick 15 Sep. 1969 18 p
(Contract N00014-68-A-0494)
(AD-694535; CAI-TM-8) Avail: CFSTI CSCL 9/2

The research activities in CAI have often been handicapped because of the inability of the computer system to function efficiently plus misunderstandings on the part of the research as to the computers capability. This paper describes the development of a new data system to resolve these problems. This system will have overlapping input-output routines and internal sequence sensitive sort procedures in order to improve the efficiency of managing the response records from a CAI study. In addition, the research designed for studying the requirements of various categories of researchers who use the system is explicated. This development will require many user-supported programs which are not in existence today. The purpose is to improve the data management and analyses operation in order that more sophisticated research may be performed. Author (TAB)

N70-15071# RAND Corp., Santa Monica, Calif.
ON LIMITS IN COMPUTING POWER
Willis H. Ware Oct. 1969 9 p refs Presented at Meteorol. Tech. Exchange Conf., Denver, 14-17 Jul. 1969
(AD-694745; P-4208) Avail: CFSTI CSCL 9/2

The document speculates on the upper limits of operating speeds for computers and on the technology required. TAB

N70-15362# Tennecomp, Inc., Oak Ridge, Tenn.
MAN-MACHINE INTERACTION IN ANALYSIS OF PULSE-HEIGHT SPECTRA
Walter R. Burrus *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1127 (See N70-15313 04-06)
Avail: SOD $8.50

Mention is made of the relative merits of highly automated spectra data processing systems and augmented processing systems in which the analyst has more direct control of pattern recognition decisions. E.C.

N70-15363# National Bureau of Standards, Washington, D.C.
PANEL DISCUSSION ON INFORMATION RETRIEVAL. THE NBS AUTOMATED ACTIVATION ANALYSIS INFORMATION RETRIEVAL SYSTEM
G. J. Lutz, R. J. Boreni, R. S. Maddock, and W. W. Meinke *In its* Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1128–1130 (See N70-15313 04-06)
Avail: SOD $8.50

Indexing, and computerized storage and retrieval processing procedures are cited for an activation analysis information system used to support current awareness and bibliography preparation requirements. E.C.

N70-15364# Budapest Science Univ. (Hungary). Inst. of Inorganic and Analytical Chemistry.
EDGE-PUNCHED CARD LITERATURE RETRIEVAL SYSTEM FOR ACTIVATION ANALYSIS
T. Braun, E. Bujdoso, and M. Miskei *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1131–1137 refs Prepared in cooperation with Res. Inst. for Non-Ferrous Metals (See N70-15313 04-06)
Avail: SOD $8.50

The bibliography composed on the basis of the system described is suitable to render information rapidly and accurately on the following activation analysis problems: (1) determination elements in general or in a given matrix, (2) citation of publications in a given field, by author, year, or by paper type (periodical, book, conference proceedings), and (3) selection of analytical processes or publications on major technical topics (nuclear data, sensitivity, self-shielding, etc.). Author

N70-15365# Oak Ridge National Lab., Tenn.
ISOTOPES INFORMATION CENTER
P. S. Baker *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1138–1143 Sponsored by AEC (See N70-15313 04-06)
Avail: SOD $8.50

Methodology used in accessioning, indexing, and retrieving items in an information system on isotopes is reviewed. Applications of the system are cited, and system indexing subject headings are shown. E.C.

N70-15399*# Computer Associates, Inc., Wakefield, Mass.
ON THE BASIS FOR ELF: AN EXTENSIBLE LANGUAGE FACILITY
T. E. Cheatham, Jr. 13 Jun. 1968 40 p refs
(Contracts NAS12-563; DAAB03-C-68-0064)
(NASA-CR-86301; CA-6806-1311) Avail: CFSTI CSCL 09B

A philosophical basis and motivation for an extensible language facility is presented. The need for a variety of programming languages and exploring several alternative ways of providing for this variety is discussed. The overall design criteria which have provided the sources of constraint in the development of the extensible language facility is discussed. The facility is considered from three points of view as a language, from the point of view of compiling programs in the language, and from the point of view of the interface between the language and the system. Author

N70-15408# Advisory Group for Aerospace Research and Development, Paris (France).
DISPLAYS FOR COMMAND AND CONTROL CENTERS
Irving J. Gabelman, ed. (RADC) Slough, England Technivision Services Jul. 1969 526 p refs Proc. of the 11th Tech. Meeting, Munich, 11 – 14 Nov. 1966 *Its* AGARD Conf. Proc. No. 23
Copyright. Avail: CFSTI

A wide variety of visual display devices with differing characteristics are described for manned command and control systems. Human engineering aspects as well as information display technologies are considered in equipment design and emphasis is

placed on military applications. For individual studies see N70-15408 through N70-15442.

N70-15409# Data Dynamics, Inc., Fort Walton Beach, Fla.
IDENTIFICATION OF DATA DISPLAY REQUIREMENTS IN COMMAND CONTROL
John H. Proctor *In* AGARD Displays for Command and Control Centers Jul. 1969 p 1–13 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI

Presented are systematic methods of identifying information requirements during the evolutionary development of a command control system. Viewing the command control system as basically an information processing problem solving system, this chapter emphasizes the necessity of specifying information requirements prior to the design of man-display partnerships. Five questions relating to display justification in command control are discussed within functional analysis and design techniques as they have been successfully applied to command control system development: (1) What data handling needs to be done that cannot be done with available user command resources? (2) When and where must different types of information handling occur? (3) What can a display sub-system do to meet information handling requirements? (4) What workloads do possible display applications imply for the commander's staff? and (5) What are the using command's requirements for technical capability to install, operate and maintain current display devices? Author

N70-15412# Royal Armament Research and Development Establishment, Fort Halstead (England).
CONSIDERATIONS AFFECTING THE CHOICE OF DISPLAY FOR AN ARMY FIELD FORCE AUTOMATIC DATA PROCESSING SYSTEM
G. Wooldridge *In* AGARD Displays for Command and Control Centers Jul. 1969 p 37–47 (See N70-15408 04-08)
Copyright. Avail: CFSTI

The chapter presents the broad military requirements for a general-purpose EDP system in the field army, including the types of data to be handled and the processing required. Cartographic and tabular displays will be required, and the particular display requirements demanded by the system concept are discussed from the operational and functional aspect. Display requirements are also examined in relation to current technology and it is judged that a small display-drive computer is necessary at each console. In view of rapidly advancing display technology, possible lines of development for second-generation systems are discussed. The evolutionary nature of development of military EDP systems of the type envisaged and the novel problems of such developments are emphasized. Author

N70-15414# Army Personnel Research Office, Washington, D.C.
INFORMATION TRANSFER FROM COMMAND-CONTROL DISPLAYS
Seymour Ringel *In* AGARD Displays for Command and Control Centers Jul. 1969 p 67–80 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI CSCL 09B

A research program and several studies oriented toward improving combat effectiveness of command-control systems are summarized. Subjects were administered series of alphanumerical (charts, totes) and graphic-symbolic (military units deployed) displays. A number of variables were experimentally manipulated and subjects were required to answer questions, solve problems and make decisions on the basis of the displayed information. Findings lend support to the incorporation and use of relatively simple information coding capabilities in command-control systems. Other findings imply that one should not focus on accuracy or quality of performance to the exclusion of confidence, itself a basic ingredient in decision behavior. Still others suggest work methods to be used by operational personnel and the use of the computer as an aid to performance rather than merely as a display driving device. Finally, some doubts are raised concerning the relative merits of large group displays and of elaborate graphic generation and display devices, at least for certain kinds of tasks. Author

N70-15417# Burroughs Corp., Paoli, Pa.
A STUDY OF THE RELATIONSHIP AMONG SPECIAL SYSTEM FONTS, ELECTRONICS AND SUBJECTIVITY
Charles P. Halsted *In* AGARD Displays for Command and Control Centers Jul. 1969 p 105–127 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI

This chapter is designed to illustrate pictorially the relationship existing between the number of bits in the symbol memory and the font flexibility of the symbol being generated. In the present state of the art there are dozens of techniques employed for producing symbols on the cathode ray tube screen. In all cases, the information required to create the symbol on the screen is stored in some form of memory. The word from the refresh memory is logically directed to the section of the symbol memory containing instructions for making a particular symbol. 'Entropy' as applied to information theory is a measure of information capacity. The actual relationship between font flexibility and entropy is a function of the efficiency with which the designer utilized the information capacity of the symbol memory. Entropy is a measure of the total number of different symbols which a generator can be programmed to provide. More than a dozen different alphabets are illustrated and a measure of entropy given for each. Many illustrations are used to provide a link between the subjective symbol quality and the electronics required to produce it. Author

N70-15418# Norwegian Defence Research Establishment, Kjeller.
COMPUTER DISPLAY FOR VIEWING OF EXPERIMENTAL DATA
Yngvar Lundh *In* AGARD Displays for Command and Control Centers Jul. 1969 p 129–136 (See N70-15408 04-08)
Copyright. Avail: CFSTI

This chapter discusses the use of automatic computing machinery for analysis of large masses of recorded experimental data. An important point concerning handling of experimental data is the possibility for the experimenter to see graphical representations of the data at various stages. A 'data-laboratory' is sketched, which consists of the necessary equipment. Two main items are a digital computer and a CRT-display system. The complete data processing is outlined from various suitable methods of data recording and up to a selection of typical mathematical processes for analysis. An essential point is the close co-operation of man and machine, each doing the processes of which he is best capable. Author

N70-15419# System Development Corp., Santa Monica, Calif.
A GENERAL PURPOSE DISPLAY SYSTEM FOR COMMAND AND CONTROL
Donald L. Drukey *In* AGARD Displays for Command and Control Centers Jul. 1969 p 137–152 (See N70-15408 04-08)
Copyright. Avail: CFSTI

Developed is a program which provides a user-oriented vehicle for the non-programmer to develop his own display formats at a cathode-ray-tube console. This tool is potentially valuable for various military analysts and planners, as well as anyone interested in experimenting with data from a large data base. This chapter describes the system briefly, provides an illustration of its power, and discusses its virtues and shortcomings. Author

N70-15420# Informatics, Inc., Bethesda, Md.
THE DISPLAY ORIENTED COMPUTER USAGE SYSTEM: A GENERAL PURPOSE SOFTWARE PACKAGE FOR DISPLAY SYSTEMS

Werner L. Frank *In* AGARD Displays for Command and Control Centers Jul. 1969 p 153–173 (See N70-15408 04-08)
Copyright. Avail: CFSTI

The increasing utilization of display systems within military command and control environments is leading to the development of software concepts and structure appropriate to on-line display/computer systems. The display Oriented Computer Usage System (DOCUS) is such an example of a complete on-line display software package. It has a general purpose operating system for managing on-line display consoles in a multi-access environment; a display oriented language which is used to describe and implement man/machine procedures; a compiler which accepts the higher order display oriented language and produces conversation mode procedures which will perform within the on-line operating system; a library capability for handling of displays, data and programs; and a user capability for combining existing programs and displays to generate more complicated operations. The basic structure of DOCUS and examples of the display oriented language are described. Costs of program size, programming development and implementing man/machine procedures within DOCUS will be compared to ad hoc programming solutions. Examples of existing systems are cited. Author

N70-15421# Airborne Instruments Lab., Deer Park, N.Y.
DISPLAYS FOR COMMAND AND CONTROL
Murray Schwartz *In* AGARD Displays for Command and Control Centers Jul. 1969 p 175–183 (See N70-15408 04-08)
Copyright. Avail: CFSTI

This chapter is an attempt to cover some important software design considerations of display/retrieval systems of the type that would provide a data base probe, offering flexibility and response speeds critical to the user in a command and control situation. A system providing for data base dialogue where communication is carried out through display and positional indicators, is outlined. The questions of data base organization and maintenance are treated, together with the critical design parameters of a question-tree query language. The feasibility of such a data base interrogation system operating in conjunction with a synthetic situation is discussed and a survey of recent developments in system techniques providing these content-adaptive situation displays is presented. Author

N70-15422# IBM Italia, Rome.
THE USE OF THE IBM 2250 DISPLAY UNIT IN A TYPICAL COMMAND AND CONTROL PROBLEM: THE MESSAGE HANDLING AND SITUATION UPDATING
M. Lippolis *In* AGARD Displays for Command and Control Centers Jul. 1969 p 185–196 ref (See N70-15408 04-08)
Copyright. Avail: CFSTI

Discussed is the possibility of introducing the use of electronic computers in command and control centers operating according to the traditional manual procedures. The chapter emphasizes the relevant importance and the substantial role of the programming support in realizing the man-to-machine interface, and in increasing the flexibility in the operational use of a given display equipment. It is shown how the importance and the influence of the programming support on the system's operation appear to be prominent with respect to the technical characteristics of the console itself. The example describes the use of a data display console in connection with a standard computer of the IBM/360 series. Features of the programming support which enable the human operator to carry out a dialogue with the computing system in the simplest way are described. A typical problem of the display of a TTY message is discussed and an interesting application of the IBM 2250 console in solving the message retrieval problem is suggested. Author

N70-15423# Bunker-Ramo Corp., Canoga Park, Calif.
A FLEXIBLE AND VERSATILE DISPLAY FOR COMMAND AND CONTROL—THE BR-90
Frank J. Beach *In* AGARD Displays for Command and Control Centers Jul. 1969 p 197–209 (See N70-15408 04-08)
Copyright. Avail: CFSTI

A visual analysis console was developed as part of a total system to provide: (1) multiple user access to specific information stored in a large data base; (2) user control over a high speed digital computer for on-line data processing and analysis, and (3) tools to manipulate displayed data off-line for file updating and maintenance purposes. The console presents combined electronic and photographic displays on a single cathode ray tube screen. The control logic for the console is a program stored in all integral magnetic core memory. A special keyboard, using coded mylar overlays, provides computer communication. All display data is stored in the console memory providing automatic display refresh. Author

N70-15424# Industrie Elettroniche Associate, Rome (Italy).
COMPOSITION AND ORGANIZATION OF A COMPUTER OPERATED DISPLAY SYSTEM
M. Mosca *In* AGARD Displays for Command and Control Centers Jul. 1969 p 211–218 (See N70-15408 04-08)
Copyright. Avail: CFSTI

Modern air defense systems are based upon the control of the tactical situation by means of radars and digital computers. Radar digital displays are used in these systems in order to provide a radar picture with superimposed synthetic information supplied by the computer. A computer operated display system consists of individual display consoles and of central units which provide interface on one or more computer's channels, generate the signals for the production of panoramic and alphanumeric displays and distribute them to the consoles. A buffer central unit is normally provided for interfacing with the digital computer. Information is organized into messages and synchronous or asynchronous mode of operation in data exchange can be used. The purpose of this chapter is to provide an outline of the basic system concepts involved in the design of computer-operated displays as used in modern air defense and air traffic control systems. Author

N70-15425# Marconi Co., Ltd., Great Baddow (England).
THE IMPACT OF INFORMATION PROCESSES ON FUTURE DISPLAY DEVICES
D. W. G. Byatt *In* AGARD Displays for Command and Control Centers Jul. 1969 p 219–233 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI

Examined are advantages and disadvantages of the cathode ray tube against the background of modern data systems compared with the characteristics of recent display devices, many of which are still in the research phase. The two main areas of interest are the performance of the device with respect to brightness, resolution and fast and slow operating speeds; and the convenience of display driving circuits which need to be examined in relationship to current techniques. The present state-of-the-art is considered with particular reference to electroluminescent devices, coupled with image retaining facilities, three-dimensional displays, light deflecting and modulating techniques and color displays. The characteristics of an ideal display unit are outlined in relation to the parameters previously discussed. Author

N70-15426# Philco Corp., Palo Alto, Calif.
A HIGH-PRECISION DISPLAY SYSTEM FOR COMMAND AND CONTROL
Herbert C. Hendrickson *In* AGARD Displays for Command and Control Centers Jul. 1969 p 235–245 (See N70-15408 04-08)
Copyright. Avail: CFSTI

Precision raster beam positioning, together with computer-generated synthetic digital video, is now able to produce displays technically much superior to analog deflection displays.

The most important difference is that the digital refresh memory precedes the display generator in the analog system, whereas the digital refresh memory succeeds the display generator in the precision raster system. Several major differences result in significant performance advantages for digital video display systems. These include simplification of digital display consoles; low cost of addition of repeater displays; simple mixing of camera video with digital synthetic video; elimination of the need for frequent adjustments; signal distribution is much less costly; registration of computer-generated dynamic data to reference background maps, grids, tables, etc. is perfect element-for-element and is commensurate with display resolution. Author

N70-15427# International Business Machines Corp., Los Angeles, Calif. Systems Development Div.

THE ELECTROSTATIC STORAGE DISPLAY TUBE—A NEW PROJECTION DISPLAY SYSTEM

Jan M. Engel *In* AGARD Displays for Command and Control Centers Jul. 1969 p 247–257 refs (See N70-15408 04-08)

Copyright. Avail: CFSTI

The electrostatic storage display tube combines the intrinsic charge storage property of a dielectric membrane with the high-speed, high-resolution capability of a newly developed electron gun and an independent optical system to provide bright, high-contrast, large-screen displays. The writing and recording functions of this tube have been completely separated from the actual display function, thus providing several advantages over conventional storage display tubes. A single tube may be used for theater-size displays or for hard-copy outputs on photosensitive media. Several different tube structures are described, all of which offer resolutions of about 2000 TV lines per useful field of view, good contrast and erasure times of under two seconds. Other advantages include writing times varying from one frame per hour to commercial TV speeds, and long storage of the developed image requiring no electric power without flicker. Brightness of the display is determined entirely by external light sources. Author

N70-15428# American Cyanamid Co., Stamford, Conn.

PHOTOCHROMIC FILM IN DISPLAYS FOR COMMAND AND CONTROL

George H. Dorion and Roy W. Roth *In* AGARD Displays for Command and Control Centers Jul. 1969 p 259–272 refs (See N70-15408 04-08)

Copyright. Avail: CFSTI

Interest in photochromic materials for data display systems arises from their capability to form images in a dry one-step process, in various colors and with high resolution. The reversible nature of photochromic images provides a dynamic display that also gives a time domain to the data. This chapter describes the current photochromic materials being used today, their mode of operation, and representative data display systems using these materials. At present, computer-generated data is best transferred to the photochromic film by ultraviolet-emitting cathode ray tubes. Preliminary experiments with ultraviolet lasers have shown that writing speeds in the nanosecond range are feasible. Future developments of photochromic materials for display applications are dependent on the close coordination between the data systems engineer and the developers of photochromic materials. Author

N70-15430# General Electric Co., New York.

SURFACE DEFORMABLE MEDIA AS APPLIED TO THE GENERATION OF PROJECTION COMMAND AND CONTROL DISPLAYS

G. J. Chafaris *In* AGARD Displays for Command and Control Centers Jul. 1969 p 295–310 (See N70-15408 04-08)

Copyright. Avail: CFSTI

This chapter is designed to acquaint the reader with the present state of surface deformation recording as applied to the generation of projection command and control displays. Principles of electron beam recording on thermoplastic and oil film media are briefly reviewed. Both achieved and anticipated performance of this form of recording are illustrated in terms of the advanced development of an ultra-high resolution, high-brightness projector and also in terms of a flight-tested airborne recorder/display console. These programs serve as general indicators of performance parameters to be sought in future command and control center equipments. In-air thermoplastic recording is examined in relation to current programs requiring a reusable display medium. The first application concerns the development of a 1–4 million element digital display device capable of being driven directly by a computer. The second application illustrates in-air recording as applied to the recording and subsequent projection of charactron alpha-numeric displays. Author

N70-15431# Rome Air Development Center, Griffiss AFB, N.Y.

MATRIX CONTROLLED ELECTROLUMINESCENT DISPLAYS

Charles M. Blank *In* AGARD Displays for Command and Control Centers Jul. 1969 p 311–327 refs (See N70-15408 04-08)

Copyright. Avail: CFSTI

The intent of this chapter is to provide a general review of the state of the art in large area electroluminescent matrix displays and to discuss some of the inherent properties and limitations of these displays. This is done by examining electroluminescent materials, the means of accessing large matrix displays and the control elements associated with the electroluminescent element. It is concluded that the basic limitations on such a display do not lie with the electroluminescent material or with the means of accessing; they lie rather with the properties of the control element. It is not until the problems associated with the control elements are solved that a usable display system of this type can be fabricated. Author

N70-15437# Kollsman Instrument Corp., Syosset, N.Y.

REAL TIME LARGE SCREEN DISPLAY SYSTEMS – 1968

Robert C. Klein *In* AGARD Displays for Command and Control Centers Jul. 1969 p 419–434 refs (See N70-15408 04-08)

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Large screen display systems capable of providing high intensity real time presentation of data on screens 6 meters times 6 meters and larger, under high ambient lighting conditions, have proven their effectiveness and reliability in operational command and control installations. This chapter discusses the characteristics and capabilities of existing display hardware and peripheral equipment and variations of this gear, currently in the pre-production stage, which significantly enhance its flexibility and scope of application. Performance characteristics of the display system portion of the AN/FYQ-9 data processing and display system from the serial digital input to images displayed on the screen will be considered, including: real time presentation, brightness, accuracy, resolution, contrast ratio, repeatability, superposition or mutual registration, data rates, reliability (MTBF), repairability (MTTR), equipment qualification, logistics support considerations, input characteristics, redundancy and fail-safe. Equipment described is directly applicable to many other information management functions. Author

N70-15440# Service Technique des Telecommunications de L'Air, Paris (France)

STRIDA 2 AIR DEFENSE SYSTEM

J. M. Chabanas *In* AGARD Displays for Command and Control Centers Jul. 1969 p 457–466 (See N70-15408 04-08)

Copyright. Avail: CFSTI

This chapter outlines the essentials of knowledge acquired in the operational use of the whole generation of STRIDA II consoles (air defense system). The data display system has been

designed with three parallel chains: topographic display, tabular display and actions on the computer. The chapter describes the operation of the displays and explains how the raw data emanating from the radar is permanently mixed with the synthetic situation elaborated by computers. The organization of work positions is described and the chapter shows how the standard console, which is the system's basic element was realized. Main trends of the new generation of display equipment are outlined showing the evolution toward greater operational flexibility with a favorable efficiency/cost ratio in the most varied future system configurations. Author

N70-15441# Burroughs Corp., Paoli, Pa.
THE COMMAND AND CONTROL DISPLAY SYSTEM FOR NORAD
Karl J. Zimmer *In* AGARD Displays for Command and Control Centers Jul. 1969 p 467–488 (See N70-15408 04-08)
Copyright. Avail: CFSTI

The primary concern in this chapter is with the theory and operation of the camera processor projector unit; however, brief attention is given to the operation of this unit in conjunction with a central computer and an electronic basic display unit. The generation of seven-color projection displays from black and white film is described, and the details of processing this film within 10 seconds are set forth. The major components of the CPPU and their unique operating features are explained, and a representation of each of the modules is furnished. Details of the redesign of a new interchangeable xenon lamp module are discussed, and the problems in designing a shield to protect the fragile condenser optics are noted. Some of the advantages and disadvantages of the CPPU are pointed out. Detailed operating characteristics and engineering data regarding the function of the CPPU are summarized. Author

N70-15442# Philco Corp., Palo Alto, Calif.
THE DISPLAY/CONTROL COMPLEX OF THE MANNED SPACE MISSION CONTROL CENTER
Herbert C. Hendrickson *In* AGARD Displays for Command and Control Centers Jul. 1969 p 489–503 (See N70-15408 04-08)
Copyright. Avail: CFSTI

This chapter describes the display/control system and the key technical decisions at the Mission Control Center at Houston, a large powerful, and flexible command and control facility which directs Gemini and Apollo manned space flights. Five key design decisions permitted this system to have great power and flexibility and allowed this largest of all command and control centers to be in operation controlling a complex mission only 18 months after contract award: (1) the consoles should be truly modular; (2) it should be easy to see over the consoles and they should be cool, silent and as empty of equipment as possible; (3) computer-generated television would be the main source of display data; (4) the displays were designed so that the computer would not have to generate display background data; and (5) all digital data cables among system equipment cabinets and consoles should be identical and contain no 'Y' branches. Author

N70-15480*# Computer Associates, Inc., Wakefield, Mass.
BASEL: THE BASE LANGUAGE FOR AN EXTENSIBLE LANGUAGE FACILITY
Alice E. Fischer and Philippe Jorrand 28 Jun. 1968 40 p
(Contract NAS12-583)
(NASA-CR-86300; CA-6806-2811) Avail: CFSTI CSCL 09B

BASEL which is a primitive algol-like programming language, both self-extensible, and adaptable through lexical, syntactic and other extensions is described, and the design criteria are given. The primitive program elements of BASEL are enumerated, and examples are used to illustrate the general character of the language. Expressions, declarations, program structure, and control statements are presented. It is concluded that a useable and practical unambiguous language was developed. F.O.S.

N70-15485# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
ALGORITHMS FOR CORRECTING CARRIES IN A CARRYING ADDER, WITH AN EXAMPLE FROM ARRAY SOFTWARE
Nicholas Zvegintzov Jun. 1969 43 p refs
(Contract F44620-67-C-0058)
(AD-695069; AFOSR-69-2573-TR) Avail: CFSTI CSCL 9/2

A carrying adder is defined as a device that takes two integer n-tuples, adds corresponding positions sequentially from the right, mod some predefined radix, and transmits a 1 to be added in the next left position each time the mod operation is non-trivial. One of the two principal storage methods for arrays has the characteristic that the integer sum of two represented array points corresponds to their carrying sum. A fixed time algorithm is described for distinguishing true carries from propagated carries, and compared with other algorithms. A table lookup algorithm is described for detecting carries in the array example and its efficiency is discussed. Author (TAB)

N70-15495*# Arizona State Univ., Tempe. Industrial Engineering Faculty.
FOUR GERT VIEWS OF PLANNING R AND D PROJECTS
A. Alan, B. Pritsker and Ronald A. Enlow 1969 27 p refs
(Contract NAS12-2035)
(NASA-CR-86279) Avail: CFSTI CSCL 09B

Graphical evaluation and review technique (GERT) is explained in terms of its applicability in research and development planning processes. A network model is presented for planning R and D projects based on the philosophical or scientific method, idea generation or psychological method, administrative or business orientation, and engineering or technological viewpoints. Charts and graphical representations are given to explain the GERT network forms. J.M.C

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-14146*# Honeywell, Inc., Lexington, Mass. Radiation Center.
INFRARED PHOTODETECTOR Final Report, 13 May 1968–12 May 1969
12 May 1969 94 p refs
(Contract NAS5-11554)
(NASA-CR-107351) Avail: CFSTI CSCL 09A

This study resulted in the production of high performance, 12 micron (hg,Cd)Te infrared photodetectors for operation at 120 K or above. In particular the study determined the internal mechanisms of the (Hg,Cd)Te detector which controlled its performance at this elevated operating temperature. The program was divided into six main areas: theoretical calculation of the optimum device parameters, bulk measurement, selection of materials and preliminary data at 78 K, extensive temperature dependent measurements, correlation of theory and data, updating of the computer program, and final selection and testing prior to shipping. In particular, the correlation between theory and experiment was excellent for bulk material parameters under varying temperature

and field-of-view conditions. For example, the device functions such as the lifetime, g-r noise current, signal current, and the detectivity compared favorably with the theory. Author

N70-14168# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE USE OF ELECTRON BEAMS FOR VISUAL CONTROL DURING THE EXECUTION OF CERTAIN PHYSICO-TECHNOLOGICAL PROCESSES

V. P. Derkach et al 3 Apr. 1969 11 p refs Transl. into ENGLISH from the Russian

(AD-695234; FTD-HT-23-1295-68) Avail: CFSTI CSCL 9/5

In many laboratory investigations and, particularly, when working on the technique of preparing microcircuits in a vacuum chamber, along with precise measurements of individual parameters, it is frequently necessary to have visual observation of the base layer as a form of quality control. This is usually done directly through an observation window or with the aid of special optical devices or scanning microscopes which give an image of objects in electron rays and in x-rays arising under electron bombardment. Scanning microscopes make it possible to observe the topography of the objects surface, its structure, the presence of defects, the arrangement of microcircuit components. The resolving power of these microscopes is several microns and can reach hundreds of angstroms. Author (TAB)

N70-14226*# Missouri Univ., Columbia. Dept. of Electrical Engineering.

DESIGNERS MANUAL FOR ELECTRICAL AND ELECTRONIC FILTERS Final Report

Joseph Barbay 8 Aug. 1969 333 p refs

(Contract NAS12-2041)

(NASA-CR-86288) Avail: CFSTI CSCL 09A

This handbook provides the NASA engineer with a reference text for design procedures applicable to many filter design problems. These design procedures serve as a background in the techniques of filter design, a background which will enable the engineer to solve many practical filter problems. The design techniques presented are all standard, well documented techniques. The computer program, NASAP-69 is utilized in the analysis of filters which result from the application of the various design techniques. This essential step in each design procedure insures that the final filter fulfills the original specifications. Author

N70-14258*# Franklin Inst., Philadelphia, Pa. Research Labs.

METEOROID SENSOR MATERIAL DEVELOPMENT Final Report, 20 Sep. 1968 - 20 Sep. 1969

P. J. Reucroft, P. L. Kronick, F. J. Sweeney, and F. L. Serafin 20 Sep. 1969 36 p

(Contract NAS9-8830)

(NASA-CR-102036; F-C2386) Avail: CFSTI CSCL 09A

Several dielectrics have been evaluated for use in micrometeoroid sensor capacitors. Dielectrics evaluated included Parylene N and C, Polysulfone, Laxan, Estane, Tyril, Acryloid, Penton and aluminum oxide in various composite arrangements. The capacitor sensors fabricated were subjected to electrical testing, which included the measurement of dielectric properties, electrode resistance, D.C. leakage current and the effect of polarity reversal, shelf-life tests, environmental tests, mechanical tests, and particle impact tests. The most satisfactory micrometeoroid sensors were made from films of Parylene. It was concluded that the higher reliability of Parylene was due to the greater precision of control in the Parylene film process over that in the film casting process used for the other materials. Thus the test results in the report do not reflect on the material properties of the dielectrics tested, but only the present feasibility of making sensitive units using fabrication processes at hand. Author

N70-14268# National Bureau of Standards, Washington, D.C. Electronic Technology Div.

MEASUREMENT METHODS FOR THE SEMICONDUCTOR DEVICE INDUSTRY: A SUMMARY OF NBS ACTIVITY

W. Murray Bullis Dec. 1969 25 p refs

(NBS-TN-511) Avail: SOD $0.30

Work at NBS which led to the development of a broad program on methods of measurement for semiconductor materials, process control, and devices is described. Initial work was concentrated on resistivity of silicon wafers and second breakdown in transistors. In the first case, the basis for a significant improvement in the method for measuring resistivity of silicon wafers was established, and in the second, concepts were developed which formed the basis of a new type of specification for operating conditions free from second breakdown. Work was extended to include other projects, including studies of germanium for gamma ray detectors, carrier lifetime, and resistivity inhomogeneities which are still in progress. Formation of the broad program in response to increased interest in improved measurement methods is described. Author

N70-14274# Atomic Energy Commission Research Establishment, Riso (Denmark). Electronics Dept.

THE THEORY AND DESIGN OF A DUAL SYNCHRONOUS NULL INDICATOR FOR A FIXED AUDIO FREQUENCY

Joseph M. Diamond Jan. 1969 24 p refs

(Riso-M-842; R-1-69) Avail: CFSTI

A fixed frequency phase sensitive detector is described which displays both in-phase and quadrature components of the signal voltage. The instrument has been designed for bridge balancing at 1005 Hz, and includes an oscillator, phase splitter, phase shifters, detector circuits, squaring circuits and metering circuits. The design of these circuits is discussed, and in addition the general problems involved in the design of a sensitive phase sensitive detector are considered. These include the equivalence of the multiplier and gating types of detector, the equivalence of pre- and post detection filtering as regards both signal and noise, the degree of prefiltering needed to avoid noise saturation, the equivalence of half and full wave detection and the cancellation of offsets in full wave chopper circuits. Author

N70-14279# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTROLUMINESCENT MATRIX SCREEN

V. P. Derkach et al 29 Apr. 1969 5 p Transl. into ENGLISH from Russian Patent No. 190065 (Appl. No. 1012239/26-24, 14 Jun. 1965) 2 p

(AD-695351; FTD-HT-23-1374-68) Avail: CFSTI CSCL 9/5

An electroluminescent matrix screen, containing a glass base, system of transparent longitudinal busses, an electroluminescent layer, a photoconducting layer, and a system of transverse busses, is distinguished in that, with the goal of increasing the excitation selectivity of the electroluminescent cells, the opaque layer is located between the electroluminescent and the photoconducting layers, over which, in turn, a solid, semi-transparent electrode, an additional electroluminescent layer, and a system of transverse busses are placed. Author (TAB)

N70-14281# Atomic Energy Commission Research Establishment, Riso (Denmark). Electronics Dept.

A SIMPLE DIGITAL TIMER

L. R. Jenkin Nov. 1969 11 p

(Riso-M-830; R-33-68) Avail: CFSTI

A digital timer is described, employing TTL integrated circuit logic, which achieves with simple circuits a clock rate of 10 MHz, almost the toggling limit of the flip-flops used. The method of setting the time delays from a remote control panel uses a sequential

code, and withstands interference. The timer, control panel, and output pulse generators are easily changed for different delay sequences. Author

N70-14289*# International Business Machines Corp., Hopewell Junction, N.Y.
INVESTIGATION OF REFRACTORY DIELECTRIC FOR INTEGRATED CIRCUITS
V. Y. Doo, P. J. Tsang, and P. C. Li Dec. 1968 23 p refs
(Contract NAS12-667)
(NASA-CR-86290) Avail: CFSTI CSCL 09E

The process development for chemical deposition of aluminum oxide and film properties were investigated. In addition, the effect of SiO2 sublayer on the growth mode as well as the surface texture of the aluminum oxide film on silicon was studied. The masking ability of aluminum oxide film against the permeation of various doping elements including gallium, boron, and phosphorus was investigated. Property measurements on the aluminum oxide films included flat band voltage, charge density, and the turn-on voltage using MOS techniques. Some modification of the existing deposition systems was made to enable an in-situ growth of SiO2 prior to the aluminum oxide deposition. Electrical properties of this type of film were measured and compared with those containing SiO2 sublayers prepared by other methods. For better characterization, the morphology of aluminum oxide was further studied using a scanning electron microscope. Author

N70-14308# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODULAR AND MICROMODULAR ELEMENTS AND UNIFIED FUNCTIONAL UNITS OF RADIO ELECTRONIC EQUIPMENT, CHAPTER 8
P. D. Verkhopyatnitskii 26 Mar. 1969 76 p refs Transl. into ENGLISH from Elektricheskie Elementy Sudovykh Radioelektronnykh Vychislitelnykh Ustroistv, (Leningrad), 1967 p 274–343
(AD-695015; FTD-HT-23-186-69) Avail: CFSTI CSCL 9/5

The chapter discusses new and unused trends in construction and the technology of radio electronic equipment such as microminiaturization. Flat and three-dimensional modules, modular construction of blades and devices, equipment based on the application of micromodules of the graduated type, and thin film technology (molectronics) are covered in detail. Along with the reduction in weight and overall dimensions, micromodular circuits substantially improve the reliability of the equipment due to the mechanization and automation of the production of these units and blocks, the reduction in the number of soldered joints, the application of complete hermetic sealing, and the possibility of total or individual replacement of units, blocks, or entire devices. Author (TAB)

N70-14361# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM FORM OF A HIGH ELONGATED MAGNETIZING COIL OF SUPERCONDUCTING MATERIAL
G. Grinberg et al 29 Apr. 1969 12 p refs Transl. into ENGLISH from Magnitnaya Gidrodinamika (USSR), No. 2, 1967 p 145–148
(AD-695886; FTD-MT-24-433-68) Avail: CFSTI CSCL 20/3

A calculation technique (used for determining the optimum form of a highly elongated magnetizing coil made of superconducting material) is applicable to designing magnetohydrodynamic devices. The coil has the form of two long bundles of superconductors, and the problem can be considered in the two-dimensional xy plane perpendicular to the bundles. Superconductivity breaks down above a critical field intensity and the coil shape must be designed to insure the field in the superconductors. The problem is worked in relative field intensities at the bundle surface. The current density was assumed constant. TAB

N70-14368# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONTEMPORARY METHODS AND EQUIPMENT FOR MEASUREMENT OF VARIABLE PRESSURES
M. Ye. Balashov 1 Jul. 1969 29 p refs Transl. into ENGLISH from Vses. Nauchn.-Issle. Inst. Metrologii (USSR), no. 85, 1968 p 31–45
(AD-695908; FTD-MT-24-59-69) Avail: CFSTI CSCL 9/1

Sensitivity, accuracy, and the operating ranges of pressure and frequency for various pressure transducers are considered. The review is devoted to transducers employing pressure-induced variation of resistance strain gage, inductive and capacitative reactances, electromagnetic induction, magnetic permeability as well as the transducers based piezoelec., photoelec., and electrolytic effects. Author (TAB)

N70-14564# Illinois Univ., Urbana. Coordinated Science Lab.
COMPUTER-AIDED DESIGN OF BROAD-BAND AMPLIFIERS WITH COMPLEX LOADS
T. N. Trick and J. Vlach Sep. 1969 36 p refs
(Contract DAAB07-67-C-0199)
(AD-694303; R-434) Avail: CFSTI CSCL 9/5

A computer-aided design approach is developed for the broad-band matching of complex generator and load impedances to a network containing active elements. Both lumped or distributed elements can be used without difficulty, but herein only the distributed case is presented. Author (TAB)

N70-14574# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
STABLE RC NETWORKS
Hershel L. Stout Jul. 1969 17 p refs
(AD-695650; ECOM-3145) Avail: CFSTI CSCL 9/5

R-C networks with time constants within 1% of the design value and stable within 1% over the temperature range of -40 to 125C were made by designing metal film resistors to complement the characteristics of commercially available capacitors. For time constants up to 75 milliseconds, NPO ceramic capacitors offer small size and low cost. Polycarbonate capacitors were used for longer time constants. Networks containing ceramic capacitors offered no difficulty because the temperature characteristics of the capacitors can be matched by standard resistors. Metal film resistors can be manufactured with non-standard temperature coefficients which provide good compensation for polycarbonate capacitors. Author (TAB)

N70-14575# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
COMPENSATION OF ELECTROLYTE RESISTANCE BY MEANS OF CURRENT-PROPORTIONAL FEEDBACK
Cal C. Herrmann Sep. 1969 31 p refs
(AD-695653; ECOM-3172) Avail: CFSTI CSCL 7/4

Ohmic drop in electrolytes has been compensated in a conventional electrochemical potentiostat configuration. The general problem of the incorporation of IR compensation in a potentiostatic circuit is analyzed. The manner in which the time constants needed to describe the system affect the amount of feedback stable at short times or at high frequencies is discussed and a theoretical model developed for present state of the art potentiostats and operational amplifiers. The use of positive feedback in pulse and ac techniques is compared and it is concluded that great caution must be exercised in the latter with regard to detection of optimum compensation. Author (TAB)

N70-14576# Army Electronics Command, Fort Monmouth, N.J. Electronic Components Lab.
NON-LINEAR DIELECTRICS FOR TUNING APPLICATIONS

Francis J. Murdock and Charles R. Griffiths Jul. 1969 25 p refs
(AD-695623; ECOM-3148) Avail: CFSTI CSCL 20/12

Electronic tuning with non-linear dielectrics is desirable in electronic equipment since they possess large power-handling capabilities which are absent in presently used solid-state varactors. It is shown, using the experimental data in this report, that electronic tuning is possible in the VHF frequency range using presently available non-linear dielectric materials. The important factors to consider in these materials are a large non-linearity in dielectric constants, a reasonable Q, and a fast response time of the changing dielectric constant. Properties of selected compositions have been evaluated in regard to the above-mentioned factors. Author (TAB)

N70-14633# Japan Broadcasting Corp., Tokyo. Television Research Div.
COLOR TELEVISION STANDARDS CONVERTER FOR INTERNATIONAL PROGRAM EXCHANGE
Haruo Sakata, Hiroshi Tanimura, Ryuichi Kaneko, and Hideo Kusaka Jun. 1969 21 p refs *Its* Ser. 128
Avail: CFSTI

The PAL and SECAM 625/50 color television standards were converted to NTSC standards. Reversed conversion from NTSC into SECAM or PAL was accomplished using a conventional 4-head video recorder. The color signal and luminance signal multiplexing system, color signal line interpolation system, and the relationship between subcarrier frequency and line frequency when the field ratio is 5:6 are discussed. J.A.M.

N70-14685# Air Force Systems Command, Wright-Patterson AFB, Foreign Technology Div.
PRECISION FIXED COAXIAL ATTENUATOR
Yu. A. Goryachev 13 May 1969 5 p Transl. into ENGLISH from Russian Patent No. 208047 (Appl. No. 1072177/26-9, 25 Apr. 1966) 2 p
(AD-694177; FTD-HT-23-206-69) Avail: CFSTI CSCL 9/1

A fixed coaxial attenuator is made in the form of a plane absorbing plate which is connected between the body and the inner and outer conductors of the coaxial. To improve the matching of the attenuator with the coaxial, the outer conductor (at the place where the absorbing plate is fastened) is made from two elastic semicircular metal plates whose shape can be adjusted by screws as shown. The plates are connected with the outer conductor of the coaxial. TAB

N70-14688*# Brigham Young Univ., Provo, Utah.
STUDIES OF REACTION GEOMETRY IN OXIDATION AND REDUCTION OF THE ALAKALINE SILVER ELECTRODE Quarterly Report
Eliot A. Butler and Angus U. Blackham 15 Nov. 1969 31 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952268)
(NASA-CR-107432; QR-6) Avail: CFSTI CSCL 09A

The design of the model pore electrode was substantially changed. Bundles of seven and nineteen wires are tightly enclosed in channels of hexagonal cross section. Three electrodes of larger pore sizes were constructed, and subjected to oxidation-reduction cycling at constant current. Characteristic features of potential response are discussed. Charge acceptance was found to be a function not only of surface area and current, but also of pore size. Surface characteristics of the electrode are described. Author

N70-14698# Iowa Univ., Iowa City. Dept. of Mathematics.
MULTIPLE ASYNCHRONOUS SIGNALS ON A SINGLE BINARY CHANNEL
Sudhakar M. Reddy and John P. Robinson Sep. 1969 16 p refs
(Contract N00014-68-A-0500; THEMIS Proj.)
(AD-694489; THEMIS-UI-TR-18) Avail: CFSTI CSCL 9/4

A message coding is given which allows several different signal sources to asynchronously transmit binary messages over the same channel. Assuming that the messages are combined under bit by bit logical OR and are received by shift-register decoders which use the logical AND as decision devices, then a construction is given which yields a set of n different binary messages such that up to K messages can exist at any time instant in the channel. The message length grows linearly with n and as the square of K. Author (TAB)

N70-14722# Aerospace Corp., El Segundo, Calif.
A GENERAL SEQUENTIAL LINEAR FILTER
Donald J. Johnson 31 Jul. 1969 24 p refs
(Contract F04701-69-C-0066)
(AD-695454; SAMSO-TR-69-315; TR-0066(5308)-1) Avail: CFSTI CSCL 9/4

A Kalman filter that accounts for time correlated noise without augmenting the state vector or differencing the measurements is derived. The derivation also emphasizes the treatment in the estimation process of unsolved-for modeling errors in the dynamic model and in the measurement model. Author (TAB)

N70-14802# Army Foreign Science and Technology Center, Washington, D.C.
ELECTRICAL MEASURING INSTRUMENTS: GAUGED WIRES
23 Jun. 1969 13 p Transl. into ENGLISH from Russian Patent no. 1609-67
(AD-694119; FSTC-HT-23-634-68) Avail: CFSTI CSCL 9/1

This document establishes standards for the manufacture, testing, storage, packing and transportation of calibrated wires, i.e., those with specified electrical resistance values for use with panel-mounted and portable electrical instruments. Diagrams are provided which show the physical dimensions of various types of standardized wire pairs and their connecting terminals. TAB

N70-14884# Rochester Univ., N.Y. Dept. of Electrical Engineering.
BIASING CIRCUITRY FOR TUNNEL JUNCTIONS
Andrew Longacre, Jr. Oct. 1969 14 p refs
(Contract N00014-67-A-0398-0003)
(AD-695503) Avail: CFSTI CSCL 9/5

A method of generating bias has been developed which greatly facilitates studying the voltage-current characteristics of tunnel junctions. A triangle wave to sweep the bias, a dc level for offset, and a small amplitude sine wave used for taking derivatives are all summed in a dc amplifier. The junction is biased by the attenuated output of this amplifier with either a high or low impedance loadline. The two transistor circuits which largely comprise this bias supply are compact and battery-powered, minimizing grounding problems. Author (TAB)

N70-14856# State Univ. of New York, Stony Brook. Dept. of Applied Analysis.
APPLICATIONS OF CLASS K FUNCTIONS TO PASSIVE AND ACTIVE NETWORK SYNTHESIS Final Report, 1 Sep. 1967 - 31 Aug. 1968
Irving Gerst Sep. 1969 18 p refs
(Contract AF-AFOSR-850-67)
(AD-695075; AFOSR-69-2593TR) Avail: CFSTI CSCL 9/5

The report is a summary of research for the reporting period in the area of positive real functions and their realization by means of transformerless networks. TAB

N70-14919*# International Business Machines Corp., Hopewell Junction, N.Y.
INVESTIGATION OF REFRACTORY DIELECTRIC FOR INTEGRATED CIRCUITS
V. Y. Doo, P. J. Tsang, and P. C. Li May 1969 14 p refs
(Contract NAS12-667)
(NASA-CR-86292) Avail: CFSTI CSCL 09A

The research and development on dielectrics leading to integrated curcuits is reported. The effects of post deposition heat treatment on the interfacial charge density of metal-A1203-Si (MAS) and metal A1203-Si02 (MAOS) systems are discussed. It is concluded that high temperature heat treatment changes the surface charge density of MAS and MAOS structures, and it is possible to tailor surface charge density of the insulating film for use as gate insulator. F.O.S.

N70-14948*# International Business Machines Corp., Hopewell Junction, N.Y.
INVESTIGATION OF REFRACTORY DIELECTRIC FOR INTEGRATED CIRCUITS Final Report
V. Y. Doo, P. J. Tsang, and P. C. Li Jul. 1969 54 p refs
(Contract NAS12-667)
(NASA-CR-86293) Avail: CFSTI CSCL 09A

Aluminum oxide growth on silicon or silicon dioxide by chemical vapor deposition is discussed. Important parameters relating to the film growth including substrate temperature, source material composition, substrate preparation, and carrier gases were investigated. Interfacial properties of the silicon dielectrics concerning aluminum oxide deposited on thermally or pyrolitcally grown silica were studied. Selected property measurements included the flat band charge density before and after thermal bias treatment, dielectric strength, and film refractive index. The masking capabilities of aluminum oxide against common impurities of boron, phisphorus, gallium, and sodium were determined. Test devices using composite films of pyrolytic aluminum oxide over silicon dioxide as gate insulators were successfully fabricated and their electrical performance was measured. Author

N70-14965*# International Business Machines Corp., Hopewell Junction, N.Y.
INVESTIGATION OF REFRACTORY DIELECTRIC FOR INTEGRATED CIRCUITS
V. Y. Doo, P. J. Tsang, and P. C. Li Feb. 1969 9 p refs
(Contract NAS12-667)
(NASA-CR-86291) Avail: CFSTI CSCL 09A

Research and development on refractory dielectrics leading to integrated circuit application are reported. Progress during the reporting period includes: (1) measurements of V sub FB and N sub FB of sodium-contaminated MAOS samples, (2) continuous study of the effect of inert gases on film growth and C-V characteristics, (3) study of the effect of post-deposition heat treatment and other pertinent factors on N sub FB and V sub FB of MAS and MAOS samples, and (4) preparation of integrated circuits using newly developed composite films of Al203-SiO2 as the gate insulator for test IGFET devices. Author

N70-15018# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESEARCH AND DEVELOPMENT OF HIGH SPEED PROCESSOR ARRAYS Interim Report, 22 Oct. 1968–21 Jan. 1969
Mar. 1969 27 p refs Prepared by Philco-Ford Corp.
(Contract AF19(628)-5167)
(AD-694554; ESD-TR-69-246; IR-2) Avail: CFSTI CSCL 9/5

The reported work was performed during the second interim (quarterly) period of a research and development program directed toward the development of high density, high performance, complex digital arrays and their application in high speed system feasibility studies. During this interim, high speed ECL microcircuit cells of several designs were fabricated and characterized. Specific gate and reference bias circuits were selected for use in the processor arrays. Development continued on high yield microcircuit and multilevel interconnection techniques. Preliminary design of a multilevel process evaluation chip was completed. Thermal studies of discretely packaged high power (1 watt) LSI chips were made using a thermal test chip as a vehicle. Final design of a 256-bit read-only memory array was completed. The photomasks were all generated using computer aid. Author (TAB)

N70-15028# Navy Underwater Sound Lab., New London, Conn.
THE IMAGE THEORY QUASI-STATIC MAGNETIC FIELDS OF A FINITE LENGTH HORIZONTAL ELECTRIC ANTENNA LOCATED NEAR THE EARTH'S SURFACE
Peter R. Bannister 4 Jun. 1969 24 p refs
(AD-695369; Rept-1011) Avail: CFSTI CSCL 9/5

Expressions for the quasi-static range magnetic-field components, produced by a finite length horizontal electric antenna located near the earths surface, were derived by employing image theory. The two situations considered were where (1) the source is located at the earths surface and the receiving antenna is elevated (z greater than or equal to 0) and (2) the receiving antenna is located at the earths surface, but the height of the source is much less than an earth skin depth. When z and either x or y = 0, or when the measurement distance is much greater or much less than the source length or the earth skin depth or both, the expressions reduce to previously derived results. Author (TAB)

N70-15050# Ion Physics Corp., Burlington, Mass.
HIGH VOLTAGE BREAKDOWN STUDY Quarterly Progress Report, 16 Nov. 1968–15 Feb. 1969
W. R. Bell, P. C. Bolin, M. J. Mulcahy, F. Y. W. Tse, and A. Atson Aug. 1969 68 p
(Contract DA-28-043-AMC-00394(E); ARPA Order 517)
(AD-695720; OSD-1366; ECOM-00394-17; QPR-17) Avail: CFSTI CSCL 20/3

In the report a recently completed five-factor, two-level, full-factorial experiment, termed the Block-of-32, is analyzed for the factorial influences of anode material, cathode material, electrode pretreatment (hydrogen or vacuum firing), anode size and anode shape. The changes brought about on the electrode surfaces by repeated breakdowns are examined and time-to-voltage-collapse measurements are reported. Author (TAB)

N70-15104*# Case Western Reserve Univ., Cleveland, Ohio. Solid State Electronics Lab.
[ADVANCED ELECTRONIC TECHNOLOGY AND THE DESIGN AND DEVELOPMENT OF AN INTEGRAL CIRCUIT, MULTI-CHANNEL TELEMETRY SYSTEM FOR BIO-MEDICAL APPLICATIONS] Final Report, Mar. 1966–Feb. 1969
W. H. Ko, E. Yon, D. Ramseth, W. Thompson, and R. Antinone Feb. 1969 148 p refs
(Grant NGR-36-003-079)
(NASA-CR-107566) Avail: CFSTI CSCL 09A

The purpose of this project is to study and apply advanced electronic technology to the design and development of an integrated circuit, multi-channal telemetry system for bio-chemical applications. A time division multiplex system was chosen for development because the transmitter circuitry required for this type of system is compatible with both hybrid and monolithic integrated circuit technology. A pulse amplitude modulation-frequency modulation scheme of modulation was chosen for initial development of the system since FM receiving equipment with sufficient RF bandwidth for this type of modulation is readily available. A discrete component, single channal FM-FM transmitter was constructed and implanted in a dog to test the RF section of the transmitter for the proposed system, and evaluazion of water proofing and packaging was made to determine the extent of the interaction between the dog and the electronics of the transmitter. Author

N70-15124# Army Foreign Science and Technology Center, Washington, D.C.
A NEW PRINCIPLE FOR CONSTRUCTION FOR FREQUENCY INDEPENDENT SHARPLY DIRECTIONAL ANTENNAS WITH ELECTRIC BEAM SCANNING
A. I. Ardabevskii et al 19 Sep. 1969 16 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zavd., Radioelektron. (USSR), v. 11, no. 5, 1968 p 465–475
(AD-695731; FSTC-HT-23-489-69) Avail: CFSTI CSCL 9/5

A new technique for the construction of narrow beam antennas with electrical beam scanning is examined. The possibility of obtaining fully and partially frequency-independent directional patterns are discussed. Author (TAB)

N70-15135# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
INTRODUCTION TO RELIABILITY THEORY [INLEIDING IN DE RELIABILITY THEORIE]
C. A. Hermens 4 Mar. 1969 71 p In DUTCH Presented at the Space Travel Colloq., Utrecht, 4 Mar. 1969
(S-131) Avail: CFSTI

This report gives an introduction into reliability theory with emphasis on variations in circuitry for series, parallel, and stand-by systems. Different maintenance problems and corresponding test methods are considered. Calculations always assumed that the failure rate of the component was a function of application and that the circumstances under which the system worked were paramount for its reliability. Thus, the chance of condensor breakdown was always greater at higher temperatures as was failure in circuits with high oscillations. Transl. by G.G.

N70-15170 Oregon State Univ., Corvallis.
SPACE-CHARGE-LIMITED CURRENTS IN SILICON USING GOLD CONTACTS
Alan Winthrop Ede (Ph.D. Thesis) 1969 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-5827

The theoretical characteristics of space-charge-limited currents in solids are reviewed, and a survey of suitable dielectric materials and experimental space-charge-limited devices is presented. The properties of the gold-silicon contact as used in space-charge-limited devices were experimentally investigated. It was found that the observed characteristics could be explained on the basis that the gold diffuses far enough into the silicon under fabrication temperatures to set up a region of traps, which reduces the space-charge-limited component of current to a very low value. An attempt to fabricate planar space-charge-limited triodes using silicon as the dielectric and gold as the source and drain contacts was unsuccessful. Dissert. Abstr.

N70-15174*# California Inst. of Tech., Pasadena.
SPACE CHARGE EFFECTS IN CURRENT TRANSPORT Quarterly Status Report
M.-A. Nicolet and J. W. Mayer 12 Dec. 1969 8 p
(Grant NGR-05-002-100)
(NASA-CR-107556) Avail: CFSTI CSCL 09E

Experimental data are presented on the use of space charge limitations of currents (SCLC) for dosimeters. Results are given for SCLC in pi-type silicon using an ion implanted back contact of boron and an alloyed front contact of aluminum. The trapping phenomenon that appears in SCLC is inversely proportional to the temperature increase. The electrical behavior of the device is symmetrical with respect to inversion of polarity, although one of the contacts has not been implanted. A comparison of nonannealed ion implanted boron contacts with antimony and phosphorus implanted contacts on nu-type silicon indicate a general deficiency in their emission efficiency. J.M.C.

N70-15178# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BASED PARAMETERS AND PROPERTIES OF THE STANDARD FM-125 FERRITE-TRANSISTOR SERIES
L. V. Semenov et al 14 May 1969 12 p refs Transl. into ENGLISH from Tr. Soveshch. Vsesoyuznoye Soveshch. po Magnitnym Elementam Avtomatiki i Vychislitelnoy Tekhn. (Moscow), 1968 p 123–129
(AD-693824; FTD-HT-23-67-69) Avail: CFSTI CSCL 9/2

A description is given of the FM-125 series of ferrite-transistor modules, intended for digital systems with clock frequencies below 125 kHz. The series is built around five types of modules, all using 0.4 VT cores measuring 3 x 2 x 1.1 mm. These cores have the best static, dynamic, and temperature stability characteristics of all Soviet-produced cores intended for logic circuit applications. All modules make use of P16 transistors, which do not have to be preselected. The characteristics of the modules are given. All modules, depending on application, may be used as inhibit, memory, and fan-in elements. The FM-125 series consists of modules assembled in register, counter, comparator, adder, and other configurations, mounted on boards printed on both sides with 33 contacts. TAB

N70-15432# International Business Machines Corp., New York.
SOLID-STATE DISPLAY
Robert J. Lynch *In* AGARD Displays for Command and Control Centers Jul. 1969 p 329–349 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI

A study of commutation and power transfer techniques as applied to indicator type displays yielded a unique solution to this problem. A solid-state circuit configuration, ultimately to be fabricated in monolithic form, functions as a single lead analog addressable driver which can electronically select and drive a single element in a light emitting diode matrix. This can be applied to the control for X, Y and Z axes of two dimensional mosaics. This driver array also features high speed scanning and a rugged packaging capability. The present program has demonstrated scanning feasibility in a single dimension using an array of GaP electroluminescent diodes. This linear array has the light emitting point sequentially moving from left to right as the input voltage amplitude is increased. Projected applications of both the 'moving pointer' and the 'moving bar' (thermometer) are altimeters, engine performance indicators and electrical meters. Two-dimensional scanning of thin film electroluminescent panel and diode matrices, capable of single lead drive for each axis, has been demonstrated to be feasible. Author

N70-15433# Radio Corp. of America, Princeton, N.J.
FERROELECTRIC ELECTROLUMINESCENT DISPLAYS
Bernard J. Lechner *In* AGARD Displays for Command and Control Centers Jul. 1969 p 351–371 refs (See N70-15408 04-08)
(Contracts AF 33(615)-1493; AF 33(615)-2531)
Copyright. Avail: CFSTI

A family of new ferroelectric control circuits has been devised for controlling electroluminescent cells in matrix, pointer, bargraph, alphanumeric and other displays. The circuits are addressed by voltage coincidence, store and analog value of video information, and control the brightness of the electroluminescent cell in accordance with this stored value. The ferroelectric material used in these circuits is a polycrystalline ceramic lead stannate zirconate titanate and is amenable to batch fabrication by a variety of means, including doctor-blading. Four-inch long strips containing as many as 20 complete control circuits have been fabricated by this means. Techniques have been developed for addressing ferroelectric electroluminescent matrix displays either an element-at-a-time or a line-at-a-time. Simple transistor circuitry has been used to implement these techniques. A complete 1200-element ferroelectric controlled electroluminescent matrix display system has been constructed. Deriving its input signals from a vidicon camera, the

system produces moving half-tone images in real time with a highlight brightness of 16 foot Lamberts and a contrast in excess of 100 to 1. Author

N70-15482# Naval Weapons Center Corona Labs., Calif. Space Geophysics Div.
HIGH POWER VLF TRANSMITTING ANTENNAS USING FAST WAVE HORIZONTAL DIPOLE ARRAYS
Elwin W. Seeley Sep. 1969 36 p refs
(AD-695397; NWCCL-TP-881) Avail: CFSTI CSCL 9/5

Horizontal VLF transmitting dipole arrays are much easier and less expensive to construct than vertical VLF transmitting antennas in use at the present time. The horizontal dipoles have much greater power-radiating capability and bandwidth. The theoretical and experimental effects of mutual resistance on array efficiency gain over one dipole are presented. The radiation efficiency is greatly increased by increasing the wave velocity along the resonant dipole. Radiation characteristics of a theoretical 18-dipole array on Hawaiian lava are shown. The antenna radiation pattern needed at VLF in order to get omnidirectional coverage is presented. Directivity is needed due to the non-reciprocal east-west propagation attenuation. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-14146# Bonneville Power Administration, Portland, Oreg.
AN ANALYSIS OF ARC STABILITY DURING THE SWITCHING OFF OF LOW INDUCTANCE CURRENTS [ANALIZ USTOICHIVOSTI GORENIYA DUGI PRI OTKLYUCHENII MALYKH INDUKTIVNYKH TOKOV]
V. D. Radchenko 1969 15 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 9, 1968 p 27–31
(PB-184894T) Avail: CFSTI CSCL 20C

Analysis of the arc stability, carried out with the help of the theory of the stability of motion when low inductive currents are switched off, allows the establishment of the dependency of the cut-off current on the parameters of the equivalent circuit and also the characteristics of the switch's arc-extinguishing mechanism. The resulting equations suggest the possibility of increasing the cut-off current in the period of its growth even when the amount of arc cooling is increased. The calculated values of Icr for various switched-off currents and active inductive and capacitive loads agree well with experimental data. Author (USGRDR)

N70-14232# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANODE CURRENT DENSITY OF AN ELECTRIC ARC WITH CARBON ELECTRODES
P. V. Sergeev, G. A. Shepel, and R. Z. Gabbasova 30 Jan. 1969 14 p refs Transl. into ENGLISH from Inzhenerno-Fizicheskii Zhurnal, (Russian), v. 13, no. 5, 1967 p 649–655
(AD-695331; FTD-HT-23-750-68) Avail: CFSTI CSCL 20/3

The results of the measurement of current density in the anode spots of a carbon arc in the air are discussed. Dependence of this density on current value is shown, which is similar to that of the cathode spot. Author (TAB)

N70-15091 North Carolina State Univ., Raleigh.
EFFECTS OF GEOMETRIC DEVIATIONS AND NONLINEARITIES IN COHERENT OPTICAL DATA PROCESSORS
James Price Moffatt (Ph.D. Thesis) 1968 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-7662

A study of signal distortions in coherent optical data processors is presented. The distortions considered are caused by departures of signal carrying surfaces from specified geometry (geometric deviations) and by nonlinearities incurred in optical signal recording. Geometric deviations of signal carrying surfaces are shown to induce signal distortions corresponding to attenuation, frequency scaling, and phase shifts in electronic systems. Specific models are developed for commonly occurring deviations. The Kirchhoff integral solution of the scalar wave equation is used to derive quantitative relations between the parameters describing the geometry of the models and the induced distortions. A digital computer program is developed which utilizes the Tchebyscheff expansion method together with the noise-to-signal ratio to analyze given characteristics. The program is used to analyze the nonlinear characteristics of type 649-F spectroscopic plates. Dissert. Abstr.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-14133*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THEORETICAL STUDY OF THE USE OF VARIABLE GEOMETRY IN THE DESIGN OF MINIMAL-CORRECTION V/STOL WIND TUNNELS
Harry H. Heyson Washington Aug. 1969 137 p refs
(NASA-TR-R-318) Avail: CFSTI CSCL 14B

Theory indicates that, if either the width–height ratio or the model height is properly scheduled, the vertical interference velocities at the lifting system can be reduced to zero in closed on bottom only tunnels. Reductions in interference at the tail, nonuniformity of interferences, and minimum speed for recirculation free testing can be obtained simultaneously; however, these reductions are much greater in the case of variable width–height ratio. Variable width–height ratio operation of a closed tunnel can reduce the interference at the lifting system by a factor of 2 or 3. This configuration, at low speeds, can reduce interference at the tail, nonuniformity of interference, and minimum speed for recirculation free testing to almost negligible values. Author

N70-14256*# Techtran Corp., Glen Burnie, Md.
THE GUIANA SPACE CENTER [LE CENTRE SPATIAL GUYANAIS]
M. Audebert Washington NASA Dec. 1969 13 p Transl. into ENGLISH from CNES publ.
(Contract NASw-1695)
(NASA-TT-F-12656) Avail: CFSTI CSCL 14B

The origins of the Guiana Space Center are discussed. It was primarily created to satisfy the needs of the French space program which anticipated a great number of scientific experiments using sounding rockets and the orbiting of scientific satellites using the Diamant launch vehicle and its derivatives. Use of the facilities of the Guiana Space Center is international. Several of the systems available are discussed including the sounding rocket launch system.

Diamant launch system as well as the CECLES launch system. A description is given of the launch site, launch center, assembly zone and other minor installations. Author

N70-14319# California Univ., Livermore. Lawrence Radiation Lab.
CONSTRUCTION OF AN UNDERGROUND WHOLE-BODY-COUNTER SHIELD
R. V. Griffith and A. L. Anderson *In its* Hazards Control Dec. 1968 p 46–50 Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

A new type of low-background whole-body-counter shield has been built underground using serpentine which has a very low radioactive content as shield material. Author (NSA)

N70-14518# Oak Ridge National Lab., Tenn.
APPLICATION OF LOW-COST ENERGY TO PROCESSING OF SEWAGE WATER FOR REUSE
Irving Spiewak *In* AEC Abundant Nucl. Energy May 1969 p 239–247 refs (See N70-14504 04-22)
Avail: CFSTI

Water supply and sewerage systems for a city of 2 million are analyzed. Examples are given of a conventional system, a system using advanced waste treatment, and a system using complete waste-water recycle. Low-cost energy has a significant impact only on the water recycle systems, which includes a unique desalting process combining electrodialysis and distillation. Waste solids are distilled to dryness. The cost of the total water system ranges from $0.33/1000 gal for the conventional system to $0.45/1000 gal for the water recycle system. Author (NSA)

N70-14599# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DYNAMICS OF A TEST STAND ON A SELF-ALIGNING BEARING WITH AIR LUBRICATION
M. G. Arakelyan 3 Apr. 1969 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Ser. Tekhn. Nauk, v. 20, no. 4, 1967 p 50–52
(AD-694834; FTD-HT-23-1314-68) Avail: CFSTI CSCL 14/2

To simulate the revolution of an artificial satellite around a center of mass, a test stand on a self-aligning bearing with air lubrication was developed. Moments of friction and touching are very small in this system, which revolves around a single vertical axis. A photoelectric eye measures the angular rate of the platforms rotation and the results are electronically transferred to an automatic tape recorder. TAB

N70-14634*# Bendix Field Engineering Corp., Owings Mills, Md.
HANDBOOK FOR APOLLO INSTRUMENTATION SHIPS
1 Sep. 1968 114 p Supersedes MG-402;
(Contract NAS5-10750)
(NASA-CR-107404; MG-402; Avail: CFSTI CSCL 14B

Five Apollo instrumentation ships (AIS) were added to the network: three 19-class AIS (T-AGM-19, 20, and 21) for earth orbital insertion and translunar injection operations; and two 6-class AIS (T-AGM-6 and 7) for the reentry phase of Apollo missions. This handbook was prepared to acquaint flight controllers and technical personnel with mission responsibilities, and to familiarize new personnel with AIS facilities, duties, and naval terminology. Ships structure and operational systems are described, as well as the safety program. J.A.M.

N70-14934# Air Force Systems Command, Wright-Patterson AFB, Ohio.
METHOD FOR STUDYING THE CAVITATIONAL EROSION OF MATERIALS
S. P. Kozyrev 5 May 1969 5 p Transl. into ENGLISH from Russian Patent no. 188731 (Appl. no. 1023489/25-28, 6 Aug. 1965), 1966 2 p
(AD-693822; FTD-HT-23-19-69) Avail: CFSTI CSCL 14/2

The invention involves a method for studying the cavitational erosion of materials by which the test specimen is placed in a liquid in which a pressure is created. To simplify the system used for conducting the study, the surface of the specimen is steam-treated. TAB

N70-15130*# Rensselaer Polytechnic Inst., Troy, N.Y.
SHORT RANGE OBSTACLE DETECTION SYSTEMS
Gerald La Barbera Sep. 1969 41 p refs
(Grant NGL-33-018-091)
(NASA-CR-107554; RPI-PR-MP-6) Avail: CFSTI CSCL 13F

A feasibility study of an electro-optical obstacle avoidance system is used for a possible future Martian roving vehicle. The proposed system makes use of the range finding abilities of a single lens and the focus detecting properties of the Cadmium Sulphide photocell. By application of the equations of geometric optics, the lens characteristics are related, mathematically, to certain properties of the detector. Next the theory of operation of the CdS cell is investigated in the context of its ability to carry out the necessary functions of an onboard focus detector. The results indicate that: (1) the optical approach to range finding is basically sound if a suitable focus detector can be found; (2) The CdS cell falls far short of being the sort of detector needed in such a system for operation on Martian terrain. Author

N70-15404# National Bureau of Standards, Washington, D.C.
ANALYSIS OF A CAPACITY CONCEPT FOR RUNWAY AND FINAL-APPROACH PATH AIRSPACE
Nov. 1969 149 p refs
(Contract FA-69-WAI-168)
(NBS-10111; SRDS-RD-69-47) Avail: CFSTI

A maximum throughput rate concept, for the capacity of a runway and its associated final-approach path airspace, is developed as a possible alternative for some purposes to the present concept. The new concept is shown to be representable by a simple mathematical formula. In the context of a stream of IFR landings, it is shown to have other properties useful in an operational setting, in particular to have potential value in connection with cost-effectiveness analyses of proposed changes in ATC equipment or procedures. Illustrative numerical calculations and parametric sensitivity analyses are included. Suggestions for natural extensions of the present brief study are formulated. Technical appendices include peripheral studies of capacity-increasing techniques for deviating from a first-come first-served treatment of arriving aircraft. Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-14108# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ALGORITHM OF THE SCHEME OF THE SECOND METHOD OF INTEGRAL RELATIONSHIPS FOR CALCULATING SUPERSONIC FLOW OF THE EQUILIBRIUM GAS STREAMS PAST BLUNT BODIES
A. Bulekbaev 26 Mar. 1969 19 p refs Transl. into ENGLISH from Differentsialnye Upr. i Ikh Primenie (Alma-Ata), 1967 p 40–51
(AD-694837; FTD-HT-23-72-69) Avail: CFSTI CSCL 20/4

The calculation method and results of solution of a problem of axisymmetric flow around a blunt body of given shape by a supersonic stream of equilibrium- and nonequilibrium-dissociated gas are given. The complete system of equations consists of differential equations in partial derivatives written in divergent form, ordinary differential equations, and finite relations. An approximation system for any order and an algorithm of the problem for multicomponent nonequilibrium flows are given. An algorithm is also given for equilibrium flows and flows of an ideal gas with constant values of specific heat. The type of algorithm is only a function of the variable for which the approximation is made. The introduction of algorithm permits estimating the rate of practical convergence of the method of integral relations. Author (TAB)

N70-14136# Council of Scientific and Industrial Research, New Delhi (India). Aeronautical Research Committee.

STUDIES IN TWO-DIMENSIONAL FLUID INJECTION FOR THRUST VECTOR CONTROL

T. A. Diab, G. Srinivasan, M. Krishnamurthy, R. Ravindran, and R. Narasimha Jun. 1969 28 p refs

(ARC-TR-1) Avail: CFSTI

Experiments were conducted in a 1 in. x 3 in. supersonic wind tunnel on two dimensional secondary fluid injection into a uniform primary supersonic stream. Both primary and secondary fluids were air at the same stagnation temperature, but the secondary stagnation pressure was varied from about 0.2 to 2.0 times the primary value. Injection was sonic and the jet issued into the primary stream through a slit of constant width at 0 deg, 8 deg, 23 deg and 55 deg upstream (the angle being measured from the normal to the primary flow). Primary stream Mach number covered the range from 1.64 to 3.08 in the tests. The observed shape of the main shock does not correlate too well in the variables normally used in the blast wave theories. An expression in the modified variables is fitted to the similarity curve, which tends to a first order blast wave at small distances from the jet and to a Mach wave at large distances. It is also found that the separation shock in front of the main shock corresponds to a nearly constant flow deflection of about 10 degrees. Typical estimates of the interaction force show rough agreement with Broadwell's calculation. Comparison with results obtained in wedge or conical nozzles indicates that shock shapes in real rocket nozzles may be appreciably affected by refraction in the main flow. Author

N70-14137# Asian Inst. of Tech., Bangkok (Thailand).

CIRCULAR HYDRAULIC JUMP

Somchai Nirapathpongporn (M.S. Thesis) 1968 78 p refs *Its* Thesis No. 257

Avail: CFSTI

Equations of circular hydraulic jump for both laminar and turbulent boundary layers are derived and the theoretical results for the case of turbulent boundary layer are checked by experimental results. An equation of inviscid circular hydraulic jump is also derived and its results are compared with those of the viscous jump. The analytical work has been extended to the case in which the radius of the jump approaches infinity; where the results are analogous to those of two dimensional jump. The turbulent flow profile which was derived by Watson has been checked with the experimental results. Finally, two empirical relationships have been developed for design purpose. Author

N70-14172# National Aeronautical Lab., Bangalore (India).

SKIN FRICTION AND LAMINAR-SUBLAYER THICKNESS IN COMPRESSIBLE TURBULENT BOUNDARY LAYERS

K. Sheshagiri Hebbar and P. A. Paranjpe Jun. 1969 32 p refs Submitted for publication

(NAL-TN-14) Avail: CFSTI

Based on reference temperature technique for compressible flows and empirical laws of resistance for incompressible turbulent flows over smooth flat plates, simple, explicit and analytical expressions for the ratios of local skin friction coefficient, average skin friction coefficient and laminar sublayer thickness in compressible turbulent boundary layers on smooth surfaces to the corresponding values in incompressible case for the same free stream conditions have been derived as functions of Mach number, Reynolds number, Prandtl number and wall to free stream temperature ratio. The expressions for the ratios of skin friction coefficients compare very well with available experimental data including those at very high Reynolds number and those with heat transfer. The analysis brings out the appreciable effect of compressibility and heat transfer on skin friction coefficient and laminar sublayer thickness and therefore on maximum permissible roughness in compressible turbulent flows. High speed flows permit considerable increase in the permissible roughness whereas cooling of the surface decreases it. For the usual value of isentropic exponent equal to 1.4, the numerical results have been presented in the form of graphs to bring out quantitatively the appreciable effect of compressibility and heat transfer and for the convenience of users. An approximate estimate of the laminar sublayer thickness based on local fluid properties has also been appended. Author

N70-14177# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MAINTAINING FLOW SIMILARITY IN CALIBRATING NOZZLES USED IN STUDYING THE WORKING PROCESSES IN PUMPS

N. S. Ershov 26 Mar. 1969 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Aviats. Tekh. (Kazan), v. 9, no. 1, 1966 p 165–171

(AD-695197; FTD-HT-23-1224-68) Avail: CFSTI CSCL 13/7

The significance of maintaining equal Reynolds numbers (Re) on both sides of a nozzle during the calibration of nozzle type water meters in an air flow was examined. This requirement is not essential in the calibration at Re is greater than 5.8 times 10 (to the 3rd power) and air flow rates 10-22 m./sec. cylindrical or spherical nozzles with lateral aperatures positioned within 30 to 35 degrees from the nozzle axis. Suggestions are given concerning nozzle calibration for high water flow rates. Author (TAB)

N70-14180*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

CONSTITUTIVE RELATIONS FOR STRESS AND HEAT FLUX IN A SHOCK WAVE

D. Bagenoff and M. Nathenson Jun. 1969 45 p refs

(Grant NGR-05-020-245)

(NASA-CR-107312; SUDAAR-379) Avail: CFSTI CSCL 20D

A form of Maxwell's moment method is used to obtain constitutive relations for stress and heat flux for a gas passing through a shock wave. The moment of the Boltzmann equation, the square of the molecular speed in the direction of flow, together with several physical approximations are used to obtain a nonlinear expression relating stress and deformation rate, with Mach number as a parameter. It is shown that the constitutive relations for both stress and heat flux reduce to the Navier–Stokes relations for the case M = 1 and tau/p << 1, and differ from these relations by as much as a factor of two for tau/p = 1. Theoretical density profiles for shock-wave Mach numbers between 2.8 and 8 are compared with experimental data from shock waves in argon and the agreement is shown to be excellent, thus supporting the use of the proposed constitutive relations. The physical significance of the approximations used and areas for further improvement in the theory are discussed. Author

N70-14218*# Techtran Corp., Glen Burnie, Md.

ON THE RELATION BETWEEN LOCAL SKIN FRICTION COEFFICIENTS OF TURBULENT BOUNDARY LAYERS IN COMPRESSIBLE AND INCOMPRESSIBLE FLOW [UEBER DEN ZUSAMMENHANG ZWISCHEN DEN OERTLICHEN

REIBUNGSBEIWERTEN TURBULENTER GRENZCHICHTEN INKOMPRESSIBLER UND KOMPRESSIBLER STROEMUNG]
J. C. Rotta Washington NASA Dec. 1969 23 p refs Transl. into ENGLISH from WGLR Proc. of the WGLR Comm. for Aerodynamics, Sep. 1968 p 11–42
(Contract NASw-1695)
(NASA-TT-F-12712) Avail: CFSTI CSCL 20D

A rule is derived by which the law for the local skin friction coefficient in incompressible flow can be transferred to compressible flows. The rule is compared with available experimental findings, and the results are discussed. Author

N70-14221# Defence Research Establishment Toronto, Downsview (Ontario).
THE TRANSIENT RESPONSE OF AN M-LOOP SERIES FILTER SYSTEM WITH SPECIAL APPLICATION TO THE DECOMPRESSION PROBLEM IN MAN: NON-LINEAR MODEL
R. S. Weaver and R. A. Stubbs Sep. 1968 15 p refs
(DRET-674) Avail: CFSTI

This computer, which is a model for body tissue gas transfer, consists of four fixed volumes connected in series through pneumatic resistance elements made of a porous filter material. The nature of the gas flow through these pneumatic resistors is determined by the ratio of the mean pore diameters of the resistor material to the mean free path of the gas. For these resistors slip flow theory and experimental flow measurements for four gases and two gas mixtures are in good agreement. A theoretical expression is derived for gas flow through a pneumatic resistor into a fixed volume; this expression leads to excellent agreement with the observed transient gas pressure in the volume. For the pneumatic computer, four simultaneous non-linear differential equations are developed. These equations have been solved by digital and electronic analogue computer techniques; the solutions agree with the response of the pneumatic computer to within the limits of experimental error. Author

N70-14272# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN EXPERIMENTAL STUDY OF THE CAVITATION CHARACTERISTICS OF CONTRACTING NOZZLES
G. S. Nazarov 31 Jan. 1969 11 p refs Transl. into ENGLISH from Inzh. Fiz. Zh. (Moscow), v. 14, no. 3, 1968 p 423–429
(AD-695347; FTD-HT-23-695-68) Avail: CFSTI CSCL 13/7

Problems related to the appearance and development of cavitation in flow of fluid in locally constricted channels are examined. An equation is derived to link the parameters of three channel sections - at the entry, in the jet section, and at the exit for the case of separating flow; it is confirmed by experimental data for cold and hot water and kerosene. Author (TAB)

N70-14380# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FRICTION AND HEAT TRANSFER IN TWISTED FLOW INSIDE A PIPE
V. K. Migai 14 May 1969 14 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv. Eenrg. (Moscow), no. 5, 1966 p 143–151
(AD-694752; FTD-HT-23-1258-68) Avail: CFSTI CSCL 20/4

Approximate calculations of the characteristics of heat exchange and friction during turbulent flow in tubes with band-type vortex generators are compared with experimental results obtained on an air unit. Graphs are given for hydraulic friction in tubes with band-type vortex generators, heat exchange in tubes with band-type vortex generators, effect of the Prandtl number on the efficiency of heat exchange in a turbulent flow, and power comparison of band-type vortex generators. The results show that band-type vortex generators are most efficient at relatively small values. On the other hand, wire type spiral vortex generators are more efficient at large values although band-type vortex generators are still preferable at low Reynolds numbers. Author (TAB)

N70-14383# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
LOW-ASPECT-RATIO WING FLYING ABOVE AN INTERFACE BETWEEN FLUIDS OF DIFFERENT DENSITY
S. I. Putilin 5 Sep. 1969 13 p refs Transl. into ENGLISH from Gidrodinamika Bolshikh Skorostei (USSR), no. 1, 1965 p 91–98
(Contract NOw-62-0604)
(AD-695985; APL-CLB-3-T-601) Avail: CFSTI CSCL 1/3

An approximate theory is developed for a low-aspect-ratio wing moving above the interface of two fluids of different density. The main feature of the theory consists in the replacement of the exact value of the velocity potential by its value obtained at a great distance downstream from the wing. Author (TAB)

N70-14384*# United Aircraft Corp., East Hartford, Conn. Research Labs.
SYSTEMATIC TWO-DIMENSIONAL CASCADE TESTS. VOLUME 1: DOUBLE CIRCULAR-ARC HYDROFOILS
W. E. Taylor, T. A. Murrin, and R. M. Colombo 19 Dec. 1969 300 p
(Contract NAS3-4184)
(NASA-CR-72498; UARL-H910254-50) Avail: CFSTI CSCL 20D

Performance parameters and incipient cavitation indices are presented for double circular-arc hydrofoils tested over a range of systematically introduced variables in a rectilinear cascade tunnel which uses water as the test medium. Cascade configurations included various combinations of an inlet flow angle (50, 60, 70 and 75 deg), a cascade solidity (0.75, 1.00 and 1.50) and angles of incidence between positive and negative stall. For a range of corresponding cascade variables, test results with the double circular-arc hydrofoils indicate the probability of correlating water tunnel cascade data with results from cascade tests wherein air was used as the test medium, since similar trends for the test parameters are evident. Correlations of incidence angle at the minimum loss point are in excellent agreement; correlations of deviation angle at the minimum loss point indicate maximum differences of less than three degrees. Author

N70-14421# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS DYNAMICS OF SOLID-PROPELLANT ROCKET ENGINES
A. A. Shishkov 23 Apr. 1969 190 p refs Transl. into ENGLISH of the book 'Gazodinamika Porokhovykh Raketnykh Dvigateley' Moscow, Izd-Vo Mashinostroyeniye, 1968 p 1–148
(AD-696049; FTD-MT-24-73-69) Avail: CFSTI CSCL 21/8.2

In this book an attempt is made to give an account of engineering methods of gas-dynamic calculation of the solid-propellant rocket engine from the single view-point based on principles of applied gas dynamics. Author (TAB)

N70-14454# Institute for Defense Analysis, Arlington, Va. Science and Technology Div.
NEWTONIAN THEORY FOR THE STAGNATION REGION OF TWO OPPOSING HYPERSONIC STREAMS
John A. Laurmann Jul. 1969 50 p refs
(Contract DAHC15-67-C-0011; ARPA Order 5)
(AD-696066; RP-P-509) Avail: CFSTI CSCL 22/3

It is proposed that the zone of interaction between two opposing hypersonic streams can be described in terms of a thin layer of compressed gases bounded on either side by shock waves. Newtonian flow theory is used to analyze the interaction when one of the streams corresponds to the exhaust gas flow from a retro-rocket firing during flight of a high-altitude missile or spacecraft.

The ambient density is taken to be sufficiently small that the exhaust gas flow expansion is large and can be assumed to be radial. The Newtonian thin layer solution yields adequately the shape of the interacting gas layers and their thicknesses in the stagnation region along the axis of symmetry of the colliding gases, but fails to provide accurate answers for downstream regions. This is a greater limitation on the utility of this solution as compared with the corresponding hypersonic blunt-body flow results, since, in contrast to the latter case, the sonic point, and hence the region of hot subsonic flow, extends a considerable distance downstream of the stagnation region. The theory is applicable in a band of high altitudes, the range being determined at low altitudes by rocket and vehicle sizes relative to the interaction zone dimensions, and at high altitude by viscous diffusion effects. Quantitative relationships are given that can be used to determine the altitudes of validity of the results. Author (TAB)

N70-14468# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF FREE SUBMERGED JETS

N. V. Arseeva et al. 12 May 1969 18 p refs Transl. into ENGLISH from Teoriia i Praktika Szhiga Gaza (USSR), v. 3, 1967 p 56–69

(AD-695941; FTD-HT-23-990-68) Avail: CFSTI CSCL 21/2

A study was made to determine the effect of the combustion process on the formation of a free jet and to obtain more accurate data on free isothermal jets formed at nozzle exits. Comparative tests with nozzles of various profiles were conducted; and additional investigations were made of a jet with uniform initial velocity fields. The total and static pressure distribution at the nozzle exits are shown. On the basis of the investigation results it was found that the following series of steps would simplify engineering calculations: (1) the total resistance coefficient of a nozzle can be found in hydraulic manuals, and the flow rate through the nozzle is then determined. The investigation results show that if the static pressure in the jet is disregarded when determining the momentum, an error of up to 12 percent may be introduced. Author (TAB)

N70-14481# Bangalore Univ. (India). College of Engineering.

MHD FLOW OF A VISCOUS INCOMPRESSIBLE CONDUCTING FLUID BETWEEN TWO PARALLEL PLATES

N. Rudraiah and N. Devaraj Apr. 1969 28 p refs

(PGSAM-8) Avail: CFSTI

Steady flow of a viscous incompressible conducting fluid between two parallel plates, one in uniform motion and the other at rest with uniform suction at the stationary plate with a transverse applied uniform magnetic field is investigated. The basic equations of magnetohydrodynamics are reduced to third and second order non-linear differential equations and exact solution of these equations with appropriate boundary conditions is obtained. There is increase in pressure even for very small fluid suction along the stationary plate and for small Hartmann number, which clearly indicates that the suction along the stationary plate and the transverse magnetic field make the flow more stable. Further, knowing the velocity components, the induced longitudinal and transverse magnetic fields are obtained with appropriate boundary conditions. Author

N70-14567# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INFLUENCE OF VISCOSITY AND THE THERMAL CONDUCTIVITY OF A GAS ON THE PROPAGATION OF A STRONG DETONATION WAVE IN A MEDIUM OF VARIABLE DENSITY

V. G. Pavlov 14 Feb. 1969 10 p refs Transl. into ENGLISH from Trans. Aviation Inst. (Kazan), no. 89, 1965 p 132–137

(AD-694849; FTD-HT-23-1219-68) Avail: CFSTI CSCL 18/3

In this work we examine the question of conditions of existence of self-similar solutions to equations that describe the propagation of a detonation wave in a medium having variable initial density, taking into account viscosity and thermal conductivity of the gas. Author (TAB)

N70-14671*# Georgia Inst. of Tech., Atlanta.

THEORETICAL INVESTIGATION OF GAS MANAGEMENT IN ZERO-GRAVITY SPACE MANUFACTURING

Helmut F. Bauer and Julius Siekmann *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 346–350 refs (See N70-14651 04-15)

Avail: CFSTI CSCL 20D

The proposed research has as its objective the management of gases in liquefied materials in a free suspended position in zero gravity environment. The investigation shall mainly center on the degassing of liquefied materials, which shall be accomplished by accelerating the material. Also the gas-liquid-interaction, as well as methods to distribute gas properly in liquefied materials of various viscosity and surface tension shall be studied. Author

N70-14683# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN QUESTIONS OF THE GEOMETRICAL ACOUSTICS OF ONE-DIMENSIONAL NONSTEADY AND TWO-DIMENSIONAL STEADY FLOWS

A. N. Kraiko 31 Jan. 1969 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk 31 Jan. 1969 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhid. Gaza (USSR), no. 5, 1967 p 104–111

(AD-694182; FTD-HT-23-1092-68) Avail: CFSTI CSCL 20/4

An investigation was made of unidimensional (with plane, cylindrical, and spherical waves) and quasi-unidimensional nonsteady flows, as well as plane and axisymmetric steady flows. Two problems are studied: variation in the intensity of weak shock waves in the presence of effects due to the flow parameters, and interaction of weak shock waves with strong discontinuities which differ from contact (tangentia) discontinuities. The thermodynamic properties of the gas are considered arbitrary. It is noted that the formulas obtained for the interaction coefficients of the interaction of weak and strong discontinuities are preserved during nonequilibrium flow. Results are presented and compared with those of other authors. Author (TAB)

N70-14686# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE STABILIZATION OF CAVITATION NUCLEI IN FLUIDS

L. R. Gavrilov 12 Mar. 1969 6 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 13, no. 1, 1967 p 45–46

(AD-690312; FTD-HT-23-1128-68) Avail: CFSTI CSCL 20/4

The report describes an experiment performed to verify the neutralization of the bubble buoyancy in cavitation nuclei. Distilled and tap water which stood for several days was subjected to normal air saturation and a given atmospheric pressure and temperature. Additional nuclei were created by means of an impeller placed on the shaft of a small electric motor with the pump RPM and time element remaining constant. Results of the experiment indicate that with identical mixing of fluids with varying concentrations of solid impurities, the quantity of gas bubbles formed in tap water greatly exceeds the bubble content of distilled water. It is concluded that the experimental investigations agree with the proposed hypothesis of the mechanism of the prolonged existence of microscopic cavitation nuclei in a fluid. Author (TAB)

N70-14725# Wisconsin Univ., Madison. Mathematics Research Center.

ON THE PROPERTIES OF THE MOTION WITH CONSTANT STRETCH HISTORY OCCURRING IN THE MAXWELL RHEOMETER Technical Summary Report

R. R. Huilgol Jan. 1969 24 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-695664; MRC-TSR-961) Avail: CFSTI CSCL 20/4

It is demonstrated that the steady flow occurring in the Maxwell orthogonal rheometer is a motion with a constant stretch history. The five material functions arising in this flow are obtained and shown to possess a close relation with viscometric material functions. It is also shown that the rheometer can be used to determine whether the material being sheared is a simple fluid with fading memory. Author (TAB)

N70-14850# National Engineering Lab., Glasgow (Scotland). Fluids Group.
DESIGNING FOR TWO-PHASE FLOW. PART 4: PREDICTION OF PRESSURE LOSSES AT CHANGES OF SECTION, BENDS AND THROTTLING DEVICES
D. Chisholm Jan. 1969 10 p refs Held at Glasgow, 17 Jan. 1968
(NEL-388) Copyright. Avail: CFSTI

Relationships are developed for the flow of two-phase mixtures through changes of flow-cross-sections, and recommendations are made for predicting pressure losses in these situations and through valves and pipe bends. The report concludes with a record of the open discussion. Author

N70-14856# National Engineering Lab., Glasgow (Scotland). Fluids Group.
DESIGNING FOR TWO-PHASE FLOW. PART 3: PREDICTION OF FRICTION PRESSURE GRADIENTS
J. R. S. Thom (Babcock and Wilcox Co.) Jan. 1969 32 p refs Held at Glasgow, 17 Jan. 1968
(NEL-387) Copyright. Avail: CFSTI

Different methods of calculating frictional two phase pressure gradients are discussed and numerical examples are given. The report concludes with a record of the open discussion. Author

N70-14857# National Engineering Lab., Glasgow (Scotland). Fluids Group.
DESIGNING FOR TWO-PHASE FLOW PART 1: OPENING ADDRESS AND GENERAL
Jan. 1969 10 p refs Held at Glasgow, 17 Jan. 1968
(NEL-385) Copyright. Avail: CFSTI

This is the first part of the report of a meeting attended by ninety-seven visitors from industry, the universities, and research establishments. The subject was two phase flow in the vertical tubes of boilers, evaporators, heat exchangers and similar equipment. Author

N70-14873# Oakland Univ., Rochester, Mich. School of Engineering.
INJECTOR PRESSURE TRANSIENTS AND THEIR EFFECT ON DROPLET DYNAMICS. PART 1: DROPLET SPIN AND EVAPORATION RATE. PART 2: PRESSURE INDUCED SOLITARY WAVES ON A LIQUID JET Final Technical Report
P. D. Mc Cormack 15 Sep. 1969 39 p refs
(Contract AF-AFOSR-1763-68)
(AD-695065; AFOSR-69-2556TR) Avail: CFSTI CSCL 21/9.1

Pressure pulses at an orifice produce circular vortices in the emerging jet. The velocity and pressure profiles in the vicinity of the vortices have been derived analytically and resemble experimentally observed profiles. If strong enough these vortices produce solitary waves on the jet. By applying strong pressure pulses upstream of an orifice these waves have been observed in a laboratory experiment and their velocity and rate of growth have been measured. In the fully developed wave the vorticity has been expended. However, at high jet velocities, atomization of the wave occurs and it is claimed that the resulting droplets will be endowed with considerable initial angular velocity. Continued analytical work on the effect of such spin on the dynamics of droplets has been carried out. It now appears that the largest effect will be on the trajectory of the droplet which will tend to move in a direction normal to the jet direction. There is a small increase in evaporation rate due to the centrifugal potential of the droplet and this has been derived analytically. Author (TAB)

N70-14921# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
PULSATILE FLOW IN FLEXIBLE TUBE
B. R. Seymour and E. Varley Aug. 1969 95 p refs
(Contract DA-AROD-31-124-G977)
(AD-695710) Avail: CFSTI CSCL 20/4

The high frequency, time periodic, pulsatile flow of an incompressible fluid in a straight flexible tube is considered in the context of blood flow in the larger arteries. The basic axisymmetric, hydraulic or pulsatile approximation to the Navier-Stokes equations is derived. The high frequency limit of these equations yields two nonlinear partial differential equations relating pressure, axial velocity and cross-sectional tube area. The system is completed by a rate dependent wall equation which models the interaction between the fluid flow and the tube wall. The first two terms of an asymptotic solution to this system, valid in the high frequency limit, are calculated. These are shown to predict effects which are consistent with known conditions in the arterial system. A high frequency boundary layer and a low frequency flow are investigated and the propagation of weak shocks is examined. Author (TAB)

N70-14926# Bangalore Univ. (India). Univ. College of Engineering.
MAGNETOHYDRODYNAMIC PSEUDO-POTENTIAL SHEAR FLOWS OF A STRATIFIED FLUID
N. Rudraiah Aug. 1969 13 p refs
(PGSAM-12) Avail: CFSTI

Steady two-dimensional magnetohydrodynamic potential shear flows of an incompressible, inviscid, heterogeneous, and electrically conducting fluid are investigated with an applied magnetic field. The required potential equations are obtained by two methods: the modified Euler's equations and the flow force equations. General solutions for the potential equations are obtained. This general theory is applied to the following two problems: (1) flow between two horizontal boundaries and (2) flow past a semi-circle. Author

N70-14927# Bangalore Univ. (India). Univ. College of Engineering.
INNER AND OUTER SOLUTION TECHNIQUE IN MAGNETOHYDRODYNAMICS
N. Rudraiah Sep. 1969 10 p refs
(PGSAM-13) Avail: CFSTI

Steady flow of a viscous incompressible and electrically conducting fluid between two infinite parallel plates, one in uniform motion and the other at rest, with a large suction at the stationary plate was investigated in the presence of a transverse magnetic field. With a suitable transformation the modified Navier-Stoke's equations are reduced to two differential equations, a nonlinear equation of fourth order and second order. An outer solution is obtained by letting the suction parameter tending toward infinity, and by introducing a stretching variable, an inner solution is obtained. The two solutions are matched in the mixing layers, and a solution which is valid throughout the region is obtained. The results are compared with hydrodynamic results. Author

N70-14962# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POSSIBLE APPROXIMATION METHODS OF SOLVING PROBLEMS OF THE TURBULENT BOUNDARY LAYER DURING THE MOTION OF GAS MIXTURE MOVEMENT
I. P. Ginzburg 7 Feb. 1969 23 p refs Transl. into ENGLISH

from Uch. Zap. Leningr. Gos. Univ. (Leningrad), no. 388, 1968 p 36–50
(AD-694886; FTD-HT-23-1475-68) Avail: CFSTI CSCL 20/4

A general formulation of the problem of the motion of a mixture of gases in a turbulent boundary layer over a wing section or an axially symmetric body is given, as well as possible approximate methods of solution. The energy equation was solved approximately by assuming that the velocity dependence of heat capacity in both turbulent and laminar regions could be expressed as second order polynomials. The coefficients of the polynomials were determined for conditions at the wall, at the laminar sublayer boundary, and at the boundary layer surface by using equations of energy and motion. From here on the problem was approached as in the case of an incompressible flow, deriving an equation relating shear at the wall with the boundary layer thickness. Using von Karmans integral relation, a second differential equation was obtained, relating shear to the x-coordinate. The relationship between velocity and heat capacity is derived by introducing Croccos variables. Author (TAB)

N70-14969# California Univ., Berkeley. Div. of Applied Mechanics.
THE FLOW OF FLUID THROUGH AN ELASTIC SOLID
P. M. Naghdi and A. E. Green 1969 23 p refs Prepared in cooperation with Oxford Univ.
(Contract N00014-67-A-0114)
(AD-695961) Avail: CFSTI CSCL 20/11

The discussions of constitutive equations and their use in related studies by a number of writers for interacting continua, which is based on the form of theory given by Green and Naghdi, is shown to be satisfactory for many purposes even though the expressions given for the partial stresses are incomplete. Complete constitutive equations are given in this paper, and a uniqueness theorem is stated, for the slow flow of a linear viscous fluid through an anisotropic linear elastic solid. Author (TAB)

N70-14984# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
STUDY OF ROTATIONAL FLOW OF FLUIDS Final Report, 1 Sep. 1968 – 31 Aug. 1969
Hans W. Liepman and Donald Coles 31 Aug. 1969 10 p
(Grant AF-AFOSR-68-1612)
(AD-695047; AFOSR-69-2585TR) Avail: CFSTI CSCL 20/4

The general object of the study is to model an important field of geophysical fluid mechanics in the laboratory. The particular problem studied is the internal fluid motion for a spherical cavity undergoing combined rotation and precession. A spin apparatus was designed and constructed. The power source is a printed-circuit motor driven through slip rings. The design allows the spin axis of a rotor up to nine inches in diameter to be positioned anywhere between the vertical and the horizontal directions. The apparatus is adequately rigid and provides very smooth rotation at speeds up to several thousand RPM. Photographs of the motion of a fluid in a small plexiglas sphere were taken. Interesting results were obtained with the precession and spin over 90 degrees apart. Author (TAB)

N70-15006# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
WALL EFFECTS IN CAVITY FLOWS Final Report
T. Yao-Tsu Wu, Arthur K. Whitney, and J. D. Lin Apr. 1969 69 p refs
(Contract N00014-67-A-0094)
(AD-694037; E-111A.5) Avail: CFSTI CSCL 20/4

The wall effects in cavity flows past an arbitrary two-dimensional body is investigated for both pure-drag and lifting cases based on an inviscid nonlinear flow theory. The over-all features of various theoretical flow models for inviscid cavity flows under the wall effects are discussed from the general momentum consideration in comparison with typical viscous, incompressible wake flows in a channel. In the case of pure drag cavity flows, three theoretical models in common use, namely, the open-wake, Riabouchinsky and re-entrant jet models, are applied to evaluate the solution. Methods of numerical computation are discussed for bodies of arbitrary shape, and are carried out in detail for wedges of all angles. The final numerical results are compared between the different flow models, and the differences pointed out. Further analysis of the results has led to development of several useful formulas for correcting the wall effect. In the lifting flow case, the wall effect on the pressure and hydrodynamic forces acting on arbitrary body is formulated for the choked cavity flow in a closed water tunnel of arbitrary shape and computed for the flat plate with a finite cavity in a straight tunnel. Author (TAB)

N70-15019# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
RADIATIVELY DRIVEN ACOUSTIC WAVES IN A GAS IN A CYLINDRICAL TUBE-THEORY AND EXPERIMENT AT RESONANCE
Dale L. Compton Aug. 1969 224 p refs
(Contract N00014-67-A-0112)
(AD-694022; SUDAAR-385; TR-1) Avail: CFSTI CSCL 20/4

Analysis and measurements have been made for the acoustic pressure generated by the absorption of radiation in an infrared-active gas. This is a relatively simple and fundamental problem with coupling between radiative transfer and acoustic motion, and one in which the experiment can be analyzed on the basis of a reasonably complete theory. The gas is contained in a cylindrical wave tube, 10-cm I.D., 75-cm long, closed at one end with an opaque wall and at the other end with a window. Time-modulated (175 to 1100 Hz) infrared radiation from an external source enters through the window and is absorbed by the gas, raising its temperature and pressure and generating acoustic waves. The pressure in these waves is measured with a microphone, and the input radiant energy with an infrared radiometer. The present work is confined primarily to the resonant condition in which the radiation is modulated at a natural acoustic frequency of the gas in the tube. The measurements are compared with a theoretical model that predicts the pressure response for a gas in molecular equilibrium. The analysis requires neither the grey-gas assumption, nor the substitute-kernel approximation. Closed-form solutions are developed for a monochromatic pressure response and the spectral integration is then performed numerically. Comparisons have been made for CO2 and CO. Author (TAB)

N70-15037# Oregon State Univ., Corvallis. Engineering Experiment Station.
STRATIFIED RESERVOIR CURRENTS
Larry S. Slotta, ed. Oct. 1969 202 p refs *Its* Bull. no. 44
Avail: CFSTI

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2. THE NUMAC METHOD FOR NONHOMOGENEOUS UNCONFINED MARKER-AND-CELL CALCULATIONS M. D. Terry, H. T. Mercier, and L. S. Slotta 102 p refs (See N70-15039 04-12)

N70-15038# Oregon State Univ., Corvallis. Engineering Experiment Station.
ENTERING STREAMFLOW EFFECTS ON CURRENTS OF A DENSITY STRATIFIED MODEL RESERVOIR
E. Harvey Elwin and Larry S. Slotta *In its* Stratified Reservoir Currents Oct. 1969 102 p refs (See N70-15037 04-12)
Avail: CFSTI

The effect of entering streamflow on currents of a density stratified reservoir has been studied in a laboratory model to provide insight into the prediction, control, and maintenance of quality water discharge from stratified reservoirs. Experiments were performed using various concentrations of a sodium chloride solution to provide linear density stratifications. Flowfield current patterns and velocities were determined photographically. Flow pattern parameters were found relating the existence, location, and magnitude of model internal density currents to entering streamflow characteristics. The extension of these model reservoir results to prototype conditions is discussed. Author

N70-15039# Oregon State Univ., Corvallis. Engineering Experiment Station.
THE NUMAC METHOD FOR NONHOMOGENEOUS UNCONFINED MARKER-AND-CELL CALCULATIONS
Michael D. Terry, Howard T. Mercier, and Larry S. Slotta *In its* Stratified Reservoir Currents Oct. 1969 102 p refs (See N70-15037 04-12)
Avail: CFSTI

A marker and cell method for computations involving nonhomogeneous, incompressible, viscous fluids is developed. New boundary conditions which are useful in hydrodynamic and oceanographic simulation are presented. A wide range of applications are included featuring both graphic and numerical computer output. A flow chart and a listing for those interested in implementing the method are included. Author

N70-15045# Bangalore Univ., (India). Coll. of Engineering.
STABILITY OF HETEROGENEOUS FLOWS TO NONAXISYMMETRIC DISTURBANCES
C. L. Narayana (Natl. Aeron. Lab., India) and N. Rudraiah Jul. 1969 11 p refs
(PGSAM-11) Avail: CFSTI

The stability of the flow of density stratified fluid with density stratification in the annulus of two coaxial concentric cylinders is investigated for nonaxisymmetric disturbances. When the flow is only axial, the analysis of the resulting Strum-Liouville equation shows that a sufficient condition for stability is obtained. If the azimuthal velocity is present the problem is investigated under the assumption that the axial velocity is small compared to the azimuthal velocity. Then the effect of heterogenuity is to increase the critical value of the axial shear above which the flow becomes unstable. Author

N70-15048# Bangalore Univ. (India). Coll. of Engineering.
STABILITY OF RING VORTICITY
N. Rudraiah and B. V. Marriyappa (Maharaja's Coll.) Jun. 1969 25 p refs
(PGSAM-10) Avail: CFSTI

An equation of motion of an incompressible viscous fluid is derived in terms of the strength of the ring vorticity L in cylindrical coordinates. The velocity and pressure distributions of an incompressible, viscous steady fluid through the cylindrical annulus bounded by two concentric infinite pipes is investigated for the cases when the pipes are rotating and nonrotating. Using steady state velocity and the equation for the strength of the ring vorticity, the stability of an incompressible and perfect fluid between two concentric, infinite, nonrotating pipes is investigated under small disturbance in terms of the strength of the ring vorticity L, where L is the strength of the ring vorticity in steady state case. Author

N70-15068# Naval Postgraduate School, Monterey, Calif.
LAMINAR BOUNDARY LAYER SEPARATION IN OSCILLATING FLOW
Ronald Arthur Despard (Ph.D. Thesis) Jun. 1969 159 p refs
(AD-694907) Avail: CFSTI CSCL 20/4

Laminar boundary layer separation phenomena in oscillating flow was experimentally investigated. Multiple hot-wire anemometers were used to obtain instantaneous boundary layer velocity profiles on a model in an oscillating freestream. Certain instantaneous profile behavior was found to be uniquely related to wake formation, while non-wake-inducing transient flow reversals were found to occur throughout the adverse pressure gradient regime. Based on these observations, a practical definition of boundary layer separation in oscillating flows was formulated. Separation data then obtained revealed that the imposition of oscillations caused the separation point to move upstream of its steady flow location. From the data acquired, a parametric correlation of separation point location was developed. Author (TAB)

N70-15109 Princeton Univ., N.J.
A FREQUENCY-RESPONSE STUDY OF KNUDSEN DIFFUSION, ADSORPTION, AND CAPILLARY CONDENSATION IN POROUS MEDIA
John Harvey Edward Henderson (Ph.D. Thesis) 1968 195 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-10501

A balanced-cell frequency response technique has been developed for studies of Knudsen flow diffusion and adsorption in porous spheres. By sinusoidally and isothermally varying the gas volume of a closed cell containing porous beads, the dynamic behavior of the pressure response was quantitatively related to the effective diffusivity, the slope of the gas-on-porous solid adsorption isotherm, and the pore volume. In separate frequency response experiments on two sizes of spheres, helium was used to obtain bead porosities, which, in turn, were used with ethane, nitrogen, methane, and butane frequency-response data to determine the diffusive and adsorptive characteristics of the five gases in the porous media. Dissert. Abstr.

N70-15195 Case Western Reserve Univ., Cleveland, Ohio.
NON-NEWTONIAN FLOW IN COLLOIDAL SUSPENSIONS OF UNIFORM RIGID SPHERES
Martin Edward Woods (Ph.D. Thesis) 1968 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-9451

A systematic body of experimental data was obtained on the effects of particle size, volume fraction, shear stress, and electrolyte concentration, on the non-Newtonian flow of concentrated mono-dispersed polymer latexes. Electrostatic interactions were shown to be present and to cause a minimum in the non-Newtonian viscosity vs. electrolyte concentration curves. This minimum viscosity state was studied as a function of latex composition. Non-Newtonian behavior was found to be most pronounced as low electrolyte levels where electrostatic interactions were present. However, the high-shear Newtonian viscosity was independent of electrolyte concentration in the absence of particle aggregation, and depended only on the effective volume fraction. Dissert. Abstr.

N70-15405# Advisory Group for Aerospace Research and Development, Paris (France).
TABLES OF INVISCID SUPERSONIC FLOW ABOUT CIRCULAR CONES AT INCIDENCE, GAMMA EQUALS 1.4, PART 1
D. J. Jones (Natl. Aeron. Estab.) Nov. 1969 485 p refs
(AGARDograph-137-Pt-1) Avail: CFSTI

Tabulated results are presented for the inviscid flow field about several circular cones at incidence to a uniform supersonic stream. The three velocity components, pressure and density are given at points between the circular cone and the corresponding attached bow shock wave. Also some overall quantities such as normal and axial force coefficients are listed. Results are given for Mach numbers ranging from 1.5 to 20, for cone half angles from 5 deg to 12.5 deg. Author

N70-15406# Advisory Group for Aerospace Research and Development, Paris (France).
TABLES OF INVISCID SUPERSONIC FLOW ABOUT CIRCULAR CONES AT INCIDENCE, GAMMA EQUALS 1.4, PART 2
D. J. Jones (Natl. Aeron. Estab.) Nov. 1969 485 p refs
(AGARDograph-137-Pt-2) Avail: CFSTI

A continuation of the flow field tables is presented for Mach numbers ranging from 1.5 to 20, for cone half angles from 15 deg to 40 deg. Author

N70-15483# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL INVESTIGATION OF LAMINAR FLOW DEVELOPMENT IN A RECTANGULAR CHANNEL USING A LASER ANEMOMETER Final Report
W. T. Snyder and W. H. Goethert AEDC Oct. 1969 31 p refs
(Contract F40600-69-C-0001)
(AD-695032; AEDC-TR-186) Avail: CFSTI CSCL 20/4

Flow in the entrance region of a parallel plate channel was theoretically investigated by others with little or no experimental verification. Presented is a new method for the analysis which involves a linearization of the inertia terms and the introduction of a stretched axial coordinate. Solutions are obtained for the velocity distribution in an incompressible fluid which is valid from the duct inlet to the fully developed region. An experimental parallel plate channel was operated using water as the working fluid. Velocity profiles, on the basis of the stretched axial coordinate, were established with the use of a laser doppler velocimeter. These velocity profiles are compared with the theoretical profiles. A significant variation between the experimental and theoretical velocity is seen near the inlet of the channel. Author (TAB)

N70-15500# Naval Academy, Annapolis, Md. Dept. of Engineering.
CONVECTION-DIFFUSION THEOREMS
Stephen L. Passman Jul. 1969 29 p refs
(AD-696079; USNA-E-69-2) Avail: CFSTI CSCL 20/4

The existence of a very general type of convection - diffusion theorem, special cases of which occur in vorticity theory and other branches of continuum mechanics, is assumed, and some of its characteristics are studied. TAB

N70-15501# Naval Academy, Annapolis, Md. Dept. of Engineering.
A COMMUNICATION FORMULA IN CONTINUUM MECHANICS
Stephen L. Passman Jul. 1969 23 p refs
(AD-696080; USNA-E-69-3) Avail: CFSTI CSCL 20/4

A previous work (AD 696 079) proposed the existence of a general type of convection-diffusion theorem in continuum mechanics, and presented studies of the properties of this type of theorem. In this report it is demonstrated that, given a tensor of any order associated with the motion of a continuum, at least one such theorem exists. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-14115# Army Foreign Science and Technology Center, Washington, D.C.
DYNAMICS OF THE ICE COVER
D. E. Khaisin 18 Sep. 1969 263 p refs Transl. into ENGLISH from Dinamika Ledyanogo Pokrova, (Leningrad), 1967 p 215
(AD-695178; FSTC-HT-23-485-69) Avail: CFSTI CSCL 8/12

Large parts of the seas, lakes, and rivers of our country are covered with ice for long periods of time, and the Arctic Ocean, almost year round. Ice, floating on the surface of the seas, greatly changes the character of the surface wave action. Many technical problems are related to construction and the operation of hygro-technical facilities, important problems of shipbuilding and navigation under icy conditions, cannot be solved without consideration of the dynamic strength characteristics of the ice cover. The mathematical theory of wave processes developing in the ice cover floating on water under the effect of the forces of gravity, internal forces, is outlined in this book. Such a statement of the problem encompasses both the purely oceanological aspect of the problem and strength problems where the effect of a system of dynamic loads on the ice is examined. Author (TAB)

N70-14158# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
APPLICATIONS OF OPTICAL DATA PROCESSING TECHNIQUES TO GEOLOGICAL IMAGERY Final Report, 1 Jul. 1967 - 30 Jun. 1969
Ralph H. Mitchel Oct. 1969 44 p refs
(Contract F19628-67-C-0402)
(AD-695120; AFCRL-69-0386) Avail: CFSTI CSCL 8/7

This report concerns some applications of coherent optical techniques to imagery of the earth sciences. Four typical problems are included: (1) the determination of the two-dimensional wave spectrum of water waves by use of a coherent optical Fourier analyzer; (2) the detection of linear geological features from aerial photographs by optical spatial filtering; (3) the measurement of water motion by use of optical correlation techniques; and (4) image distortion correction by partitioned-field spatial filtering. Author (TAB)

N70-14174# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE RELATION BETWEEN BULK AND SHEARING PLASTIC DEFORMATIONS AND SHOCK WAVES IN SOFT SOILS
V. N. Nikolaevskii 24 Apr. 1969 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 177, no. 3, 1967 p 542 - 545
(AD-695396; FTD-HT-23-1008-68) Avail: CFSTI CSCL 8/13

Although studies of mathematic models used for the analysis of plastic waves in soft soil assume that volume and shear deformations are independent of each other, the author cites evidence to show that there is a connection between the two. This evidence was obtained from experiments performed to determine soil dilatation characteristics. In these experiments, a cylindrical specimen of the medium is subjected to hydrostatic pressure; then, with the radial stress kept constant, the axial stress is gradually increased and the axial and volume deformations measured. These experiments were done on media of sand and lead shot. Author (TAB)

N70-14204# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
THE THEORY OF THE FIGURE OF THE EARTH
N. P. Grushinskii 5 May 1969 358 p refs Transl. into ENGLISH from Teoriya Figury Zemli, (Moscow), 1963 p 1 - 446
(AD-694748; FTD-HT-23-393-68) Avail: CFSTI CSCL 8/5

Taken from lectures on higher geodesy, gravimetry and the theory of the figure of the earth, these lectures cover the fundamentals of determining the figure of the earth geodetically and

gravimetrically, i.e., measurements on the physical surface of the earth, reduction to a reference surface and the determination of the terrestrial ellipsoid. Particular attention is devoted to the Molodenskiy chord method. Geometric gravimetry is covered by consideration of the problem of constructing the potential of the earths gravitational force, with the earth taken as the ellipsoid of revolution, and the relationship between the gravitational field and the flattening of this ellipsoid is established. Also discussed are the anomalous gravitational field, celestial mechanics and satellite perturbations as part of the determination of the figure of the earth. Author (TAB)

N70-14217*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

D REGION RADIO MEASUREMENTS AT THE MAGNETIC EQUATOR

J. A. Kane Nov. 1969 16 p

(NASA-TM-X-63761; X-615-69-499) Avail: CFSTI CSCL 04A

This note reports electron density measurements from two ARCAS rocket flights at Thumba, India on 8 March 1968. D region electron density profiles were obtained from absorption measurements of C. W. radio transmissions propagating transversely to the earth's magnetic field. Author

N70-14278# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE QUESTION OF DETERMINING THE NATURAL PERIOD OF HORIZONTAL PENDULUMS WITH ZOELNER SUSPENSION

V. G. Golubitskii 3 Apr. 1969 11 p refs Transl. into ENGLISH from Inform. Byul. Geofiz. Astronomiya (USSR), no. 11, 1967 p 190–196

(AD-694814; FTD-HT-23-1325-68) Avail: CFSTI CSCL 8/5

Horizontal pendulums with Zoelner suspensions are widely used to determine tilting due to tidal effects. The period of these instruments and the errors that are inherent in them have been investigated. It has been shown that the natural period of such instruments depends on the amplitude of oscillation, and this leads to systematic error. The author tested several instruments with different periods, and found that the dependence is a peculiarity of each instrument. Two methods of handling the problem are possible: (1) determine the sensitivity of the instrument so as to bypass knowledge of natural period (direct calibration), or (2) find an expression for period as a function of amplitude and extrapolate period to infinitesimally small amplitudes. The first is not always possible, and the author examines the second method. TAB

N70-14404# Air Force Systems Command, Wright-Patterson AFB, Foreign Technology Div.

TURBULENCE IN THE UPPER ATMOSPHERE OF ALTITUDES OF 80-110 KM AND ITS RELATIONSHIP TO OTHER PHENOMENA

I. A. Delov 31 Jan. 1969 17 p refs Transl. into ENGLISH from Probl. Kosmicheskoi Fiz., Mezhvedomstvennyi Nauchn. Sbornik (USSR), no. 1, 1966 p 126–137

(AD-695881; FTD-HT-23-761-68) Avail: CFSTI CSCL 4/1

Systematic radiosonde measurements of turbulent motions and average wind speeds, carried out at altitudes of 80 to 110 km (meteor zone) over Kharkov in the period from March 1962 to December 1963, are analyzed. Vertical profiles are constructed for the mean arithmetic values of the turbulent velocity gradient, the mean square turbulent wind speeds, the mean wind speeds, and the vertical dimensions of large-scale eddies to determine the dependence of these parameters on altitude, diurnal changes, seasonal variations, and long-period variations in the mean square velocity of turbulent motions and their relationship to other phenomena (solar activity, cosmic rays). Author (TAB)

N70-14407*# Aztec School of Languages, Inc., Maynard, Mass.

TREATMENT OF DOPPLER DATA IN SEMI-DYNAMICAL GEODESY [TRAITEMENT DES MESURES DOPPLER EN GEODESTE SEMI-DYNAMIQUE]

J.-P. Chassaing Washington NASA Dec. 1969 10 p Transl. into ENGLISH from French Conf. Paper Presented at the COSPAR Meeting, Prague, 11 – 24 May 1969

(Contract NASw-1692)

(NASA-TT-F-12727) Avail: CFSTI CSCL 08E

The results obtained, in the field of semi-dynamical geodesy, by processing of Doppler data collected in three mediterranean ground stations: Stephanion (STD) (Greece); Colomb-Bechar (BCD) (Algeria); Haute-Provence (HPD) (France) are shown. The orbit parameters, the position of the stations and one frequency parameter for each station are simultaneously computed with a differential correction calculation using the least squares method. The program of differential correction is based on a numerical integration of the equations of motion (Cowell's method of the 8-th order). All the disturbances that have a known effect can be taken into account in the satellite motion theory. In making the estimation of the quality of the result, the following items were considered: scattering, confidence intervals, and the quality of the representation of the observations (interval consistency). Resonance harmonics for the interval confidence of the computations concerning the transit satellite 66.76.A are also considered significant. The study of the covariance matrix shows that the highest eigenvalue is associated with an eigenvector having 3 leading vector components, Z sub 1, Z sub 2, and Z sub 3. The annexed tabulated values show the whole processing corresponding to 7 basic cases of 1.25 days. Author

N70-14422# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF TEMPERATURE STRATIFICATION OF A MEDIUM ON TURBULENCE

A. S. Monin 16 Jul. 1969 17 p refs Transl. into ENGLISH from Atm. Turbulentnosti Rasprostranenie Radiovoln (Moscow), 1967 p 113–120

(AD-695935; FTD-MT-24-75-69) Avail: CFSTI CSCL 4/1

The following problems associated with the effect of temperature stratification on turbulence are discussed: (1) the effect of stratification on the vertical turbulent fluxes of momentum, heat and moisture; (2) the symmetric properties of turbulence in a temperature stratified medium; (3) similarity hypotheses for the inertially convective interval of turbulence spectrum in a stability stratified medium; (4) the limiting cases of instability and stability. The influence of temperature stratification and turbulence is described with the aid of three parameters-the buoyancy parameter, the friction velocity and the so-called temperature flux. Author (TAB)

N70-14446*# Porter (Ronald A.), Professional Engineer, Cambridge, Mass.

FEASIBILITY STUDY OF MICROWAVE RADIOMETRIC REMOTE SENSING, VOLUME 1

Ronald A. Porter and Edwin T. Florance 29 Jan. 1969 348 p refs

(Contract NAS12-629)

(NASA-CR-86296) Avail: CFSTI CSCL 08E

A comprehensive study was performed on the feasibility of remote sensing by earth-orbiting microwave radiometers, covering the frequency range 1 to 220 GHz. A broad range of terrestrial materials and phenomena were considered in the study. Material emissivities were determined and incorporated in expressions designed to compute apparent or brightness temperatures and contrasts at a given spacecraft radiometer. The effects of the atmosphere were taken into account. Antenna apertures of 25 and 5 feet were assigned to radiometers at 1, 10 and 17 GHz, and 35, 94, 140, and 220 GHz, respectively. In addition, specific areas were assigned to the target materials and phenomena. An analysis

of the calculated contrasts revealed 33 pairs of materials or phenomena were detectable with reasonable certainty, in a range of weather conditions. Author

N70-14447*# Porter (Ronald A.), Professional Engineer, Cambridge, Mass.

FEASIBILITY STUDY OF MICROWAVE RADIOMETRIC REMOTE SENSING. VOLUME 2: COMPUTER PRINTOUTS

Ronald A. Porter and Edwin T. Florance 29 Jan. 1969 249 p
(Contract NAS12-629)
(NASA-CR-86297) Avail: CFSTI CSCL 08E

Printouts of computed target and background brightness temperatures and contrasts are given, as well as printouts of computed sky brightness temperatures and atmospheric transmission factors. M.H.E.

N70-14448*# Porter (Ronald A.), Professional Engineer, Cambridge, Mass.

FEASIBILITY STUDY OF MICROWAVE RADIOMETRIC REMOTE SENSING. VOLUME 3: ADDITIONAL PLOTS AND PRINTOUTS

Ronald A. Porter and Edwin T. Florance 29 Jan. 1969 177 p
(Contract NAS12-629)
(NASA-CR-86298) Avail: CFSTI CSCL 08E

Printouts of sample measured apparent temperatures and derived brightness temperatures, and theoretical emissivity and brightness temperature for fresh and sea water are given. Plotted theoretical brightness temperatures of sea water in the range of 17 to 220 GHz, and theoretical brightness temperatures of fresh water in the range of 1 to 220 GHz are also given. M.H.E.

N70-14553# Army Foreign Science and Technology Center, Washington, D.C.

METHODS FOR COMPILING LARGE-SCALE SOILS MAPS USING AERIAL PHOTOGRAPHS

Yu. A. Liverovskii 1969 189 p refs Transl. into ENGLISH from Russian publ.
(AD-694579; FSTC-HT-23-734-68) Avail: CFSTI CSCL 8/7

The manuals now used by soil scientists in the Soviet Union during their work in soils mapping are much outdated. In particular, existing manuals give very little attention to the use of aerial photographs in soils mapping and many of the most authoritative manuals fail to mention aerial photographs at all. The natural result of this backwardness is that soil mapping methods in the Soviet Union are essentially the same as they were several decades ago, despite all the advances which have made it possible to improve the corresponding techniques. The manual which is presented here attempts to present to the soil scientist all the necessary background information which he requires in becoming thoroughly familiar with the use of aerial photography in soils mapping. Author (TAB)

N70-14809# Stanford Univ., Calif. Dept. of Statistics.

MAPPING A GEOGRAPHICALLY CORRELATED ENVIRONMENT

Paul Switzer 28 Jul. 1969 51 p refs
(Contract Nonr-225(52))
(AD-693982; TR-145) Avail: CFSTI CSCL 8/2

The assignment of many individuals to species is explored in the case when the data on the individuals are non-independent. The non-independence may arise naturally because of geographic proximity. These notions are extended to qualitative mapping of continuous regions based on discrete data. Some classes of models of non-independent geographic variation are examined to see how they affect the choice of an assignment or mapping rule. Errors in sample-point locations are also discussed. TAB

N70-14832*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROGRESSIVE SHOCK METAMORPHISM OF QUARTZITE EJECTA FROM THE SEDAN NUCLEAR EXPLOSION CRATER

Nicholas M. Short Dec. 1969 91 p refs Submitted for publication
(NASA-TM-X-63778; X-622-69-537) Avail: CFSTI CSCL 08G

Cambrian and Mississipian orthoquartzites, present as fragments in alluvium, experienced shock-wave pressures up to 500+ kb during the SEDAN nuclear cratering explosion. Ejecta samples display diverse shock-damage effects correlative, in part, with increasing peak pressures, that establish a sequence of progressive shock metamorphism having these principal characteristics: lower pressure, shock-induced discontinuities (planar features), progressive breakdown of crystal structure that increases directly with number and density of planar features, selective phase transformations, and refractive indices ranging between 1.463 to 1.478 for isotropized quartz compared to ranges between 1.510 to 1.546 in vesticulated quartzite. Most shock effects produced by meteorite impact into quartzose crystalline rocks and sandstones are duplicated to varying degrees in the SEDAN quartzites, but they show better development of planar features formed over the pressure interval in which impacted sandstones at some structures fail primarily by fracturing, crushing, or partial melting. This difference in behavior is explained by the relative tightness or low porosity characteristic of the SEDAN quartzites. E.M.C.

N70-14841# Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.

TEMPORAL VARIATIONS OF THE DEEP WATER AT OCEAN STATION P

S. M. Rupp Aug. 1969 47 p refs
(Contract Nonr-4010(10); Grants NSF GP-2443; NSF GA-11047)
(AD-694444; TR-57; Ref-69-10) Avail: CFSTI CSCL 8/10

Temporal variations of depth, salinity, and oxyty at selected isanosteric surfaces below 1000 m are studied at Ocean Station P (50 degrees N, 145 degrees W, 4200 meters deep) for the period 1960 to 1965. The data are 81 stations made by personnel from the Fisheries Research Board of Canada at Nanaimo, British Columbia. Surfaces of constant potential steric anomaly (isanosteric surfaces) are based on a reference pressure of 4000 db rather than 0 db to give a better representation of the deep water. Author (TAB)

N70-14842# Texas Univ., Austin. Electrical Geophysics Research Lab.

MAGNETOTELLURIC MODELING TECHNIQUES

Frederick W. Patrick and F. X. Bostick, Jr. 3 Mar. 1969 109 p refs
(Contract N00014-67-A-0126-0004; Grant NSF GA-1236)
(AD-694507; TR-59) Avail: CFSTI CSCL 8/14

The process of finding one-dimensional Cagniard models to fit experimental magnetotelluric data in a least squares sense is investigated. A modification to the Newton-Raphson method for non-linear regression is developed. This method together with the gradient method is applied to data generated from exact models and is shown to be successful, provided certain conditions on the significance of the model parameters are met. A finite difference scheme for two-dimensional models is developed. The model is restricted to be a layered model in which one of the layers possesses a lateral inhomogeneity. Boundary conditions are applied in such a way as to allow eigenfunction expansions to be written in the homogeneous layers. This in turn allows proper boundary conditions to be applied at the air-earth interface and at infinity. For the scheme which is used, the finite difference equations are written only in the anomalous layer and are solved using a direct method. Results are presented for both the transverse electric and transverse magnetic polarizations for a typical model. The impedances

generated from this model are used as experimental data to demonstrate the effect of fitting data generated from a two-dimensional earth with one-dimensional models.
Author (TAB)

N70-14717# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.
STOCHASTIC MODELS OF LUNAR ROCKS AND REGOLITH. PART 1: CATASTROPHIC SPLITTING THEORY
Technical Report
Allan H. Marcus Aug. 1969 57 p refs
(Contract NONR-4010(09))
(AD-695460; TR-122) Avail: CFSTI CSCL 8/7

It is assumed that a rock on the lunar surface loses mass as a result of the random bombardment by meteoroids. The mass of rock can be modelled as a non-increasing stochastic process with independent increments. In some cases, Filippovs model of a self-similar independent splitting process can be solved exactly. These results are extended in two directions. A new explicit asymptotic number density, which depends on a confluent hypergeometric function of the second kind, is obtained for the case that the one-shot splitting law is a two-term polynomial. The average number density with respect to a distribution of initial rock masses and initial rock birthdays has also been studied. The appropriate model parameters are estimated from laboratory hypervelocity impact and possible rock-size distributions (all approximately inverse power laws) derived for young rock populations, old rock populations, and mixtures of rock populations of various ages.
Author (TAB)

N70-14798# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ORGANIZATION OF THE CONVEYANCE OF SATELLITE INFORMATION INTO BLANKS OF GEOGRAPHIC CHARTS
V. G. Konstantinova 11 Apr. 1969 13 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr (USSR), no. 11, 1967 p 169–174
(AD-695225; FTD-MT-24-71-69) Avail: CFSTI CSCL 8/2

A specially developed system is proposed for converting the results of processing satellite meteorological information into blank spots on geographical charts. This system must meet the following criteria: the scales of image and projection must correspond to the standards practiced by the weather service, so that the image scale meets local requirements, separate blanks must be united so that charts of meteorological fields are obtained with a full closing of the field loop, the largest portion of the blank surface must be used, if possible, for the representation of a meteorological field. The authors offer an algorithm for processing the appropriate satellite data on a computer equipped with an alphanumerical printer with a wide paper roll (large number of print positions). A demonstration is made of how data can be analyzed in a coordinate grid; this grid and the processed data serve to determine the format of successive print lines of the printer.
Author (TAB)

N70-14820# Coast Guard, Washington, D.C. Oceanographic Unit.
OCEANOGRAPHIC OBSERVATIONS IN THE KARA AND EASTERN BARENTS SEAS
Andrew W. Garcia 1969 108 p refs
(AD-695438; USCG-373-25) Avail: CFSTI CSCL 8/10

In 1967 an effort was made by USCGC EASTWIND (WAGB 279), CAPT William M. Benkert, Commanding, in company with USCGC EDISTO (WAGB 284) to conduct scientific investigations while circumnavigating the Arctic Ocean. This cruise was aborted when heavy ice blocked passage to the north of Severnaya Zemlya and the Soviet Union refused innocent passage through the Vilkitskiiy Straits. As an alternative the 1967 survey of the Kara-Barents Seas, described in this paper, was conducted. A total of 125 hydrographic stations were occupied from 31 August to 22 September 1967. In addition to Nansen casts conducted at all stations, bottom samples were obtained at 27 stations and surface plankton tows at 11. Preliminary results show extensive surface cooling taking place in the Barents Sea and a water mass structure unlike those previously reported in the Kara Sea.
Author (TAB)

N70-14822*# National Aeronautics and Space Administration, Washington, D.C.
GENERAL ORDER OF OPERATIONS 6/69 FOR GEODETIC PROGRAM PREPEOLE
B. Lago Dec. 1969 19 p Transl. into ENGLISH from Ordre Gen. d Operations 6/69, Campagne Geodesique (Bretigny), Nov. 1969 17 p
(NASA-TT-F-12779) Avail: CFSTI CSCL 08E

The organization of facilities, staff, satellite observation arrangements, and a timetable of the program are described in preparation for the Peole satellite launching in August 1970. American, French, and other European participation is organized for the following purposes: (1) preparation for the geodetic organization Peole (O.G.P.); (2) improvement of performance data on the two French laser rangefinders (HOPLASI); (3) calibration of the DIANE interferometers at Kourou and Pretoria; (4) calibration of CSG and OEL radars; and (5) collection of geodetic data to increase knowledge of the terrestrial potential and the coordinates of the participating stations in a geocentric system (C8).
M.H.E.

N70-14835# Army Foreign Science and Technology Center, Washington, D.C.
THE STUDY OF THE CONCENTRATION OF LONG-DURATION RADIOACTIVE AEROSOLS OF ATMOSPHERIC AIR IN ITS RELATION TO THE AMOUNT OF DUST
M. V. Kozlova et al 18 Sep. 1969 10 p refs Transl. into ENGLISH from a Russian Report
(AD-695177; FSTC-HT-23-443-69) Avail: CFSTI CSCL 4/1

It is well known that an increase in the concentration of atmospheric dust containing stable isotopes can lead to a decrease in the specific activity of dust hovering in the air. In the given case, stable atmospheric dust appears in the roll of a factor which reduces the amount of radioactive substances in the atmosphere of air. Since it is necessary to take this condition into consideration in the hygienic evaluation of the radioactive contamination of the atmospheric air, experiments were carried out to determine the concentration of long-duration radioactive substances and dust of the atmospheric air in Moscow.
Author (TAB)

N70-14849# Weapons Research Establishment, Salisbury (Australia).
IONOSPHERIC DATA FOR MAY 1968 FROM WOOMERA, SOUTH AUSTRALIA
Oct. 1969 28 p *Its* Ionospheric Data Bull. CPD 1968/5(W)
Avail: CFSTI

Tables of the hourly values of the customary ionospheric parameters are given for the station at Woomera for May 1968.
Author

N70-14916# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
DETERMINATION OF THE EARTH'S DISTURBING POTENTIAL AND STOKES' CONSTANTS BY THE METHOD OF GREEN'S FUNCTION [OPREDELENIE VOZMUSHCHAYUSHCHEGO POTENTSIALA I STOKSOVYKH POSTOYANNYKH ZEMLI METODOM FUNKTSII GRINA]
O. M. Ostach Sep. 1969 25 p refs Transl. into ENGLISH from Tsentr. Nauchn.-Issled. Inst. Geodezii Aerosemki i Kartografii. Trudy (USSR), no. 176, 1969 p 24–42

(AD-694585; ACIC-TC-1579) Avail: CFSTI CSCL 8/5

The determination of the earths disturbing potential T from the gravity anomalies delta g given on the earths surface has been presented by Molodenskiy as the solution of the third boundary problem of potential theory. This boundary condition may be regarded as given on the first approximation of the earths surface S (the surface obtained by plotting only the normal heights outward from the reference surface). In the present paper this problem is solved by the method of Greens functions. Author (TAB)

N70-14931# Johns Hopkins Univ., Baltimore, Md.
FIELD MEASUREMENTS OF SWELL OFF THE ISLAND OF ARUBA
W. Stanley Wilson Aug. 1969 81 p refs
(Contract Nonr 4010(11))
(AD-694443; TR-56) Avail: CFSTI CSCL 8/3

Intermittently during the winter, swell and associated breakers appear along a beach on the lee side of Aruba, an island off the coast of Venezuela in the Trade Winds. It has been suggested that 14- to 15-sec waves, generated by winter storms off the mid-Atlantic coast of North America, propagate southward to Mona Passage where they are refracted. They then propagate across the Caribbean Sea toward Aruba where they are refracted off the northwest tip of the island and arrive on the leeward coast. Measurements of swell off the beach have been conducted during March 1969. The instrumentation, field procedure, and computational methods are described. Spectra, directions of travel for the swell, and probable generation areas are presented. Reasonable agreement is found between measured swell directions and directions deduced from wave-ray patterns. All evidence obtained is consistent with the hypothesis of a North Atlantic generation area. Author (TAB)

N70-14935# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
SEISMIC RISK IN SOUTHERN CALIFORNIA
Keith T. Kallberg and C. Allin Cornell Jun. 1969 74 p refs
(Grant NSF GK-4151)
(PB-186241; R69-31) Avail: CFSTI CSCL 13B

A previously developed model for computing seismic risk at a site is evaluated by applying it to sites in the southern California area. Individual parts of the model are checked and necessary parameters are evaluated using available recorded data for earthquake occurrences. Preliminary contour maps covering the region are developed for the maximum site accelerations with 100 and 200 year return periods. The results of the model predictions are then compared with the work of others. Author (USGRDR)

N70-14985# California Univ., San Diego. Scripps Inst. of Oceanography.
FLIP: FLOATING INSTRUMENT PLATFORM
Earl D. Bronson and Larry R. Glostem 2 Sep. 1969 29 p Revised
(Contract N00014-69-A-0200-6002)
(AD-694962; MPL-U-49/62; SIO-REF-69-18; SIO-REF-68-25-Rev) Avail: CFSTI CSCL 13/10

The report presents a general non-technical summation of the construction, operation and potential of the R/P FLIP, the Floating Instrument Platform. It is designed as a super-stable open-sea free-floating platform from which to conduct research in the field of physical oceanography - primarily underwater acoustics to a scale heretofore impossible due to background noise and ship movement. Author (TAB)

N70-14996# Florida Atlantic Univ., Boca Raton. Dept. of Geography.
INTERPRETATION OF COLORS BY A TELEVISION SCANNING AND WAVEFORM SYSTEM APPLIED TO GEOGRAPHIC ANALYSIS OF MULTISENSOR IMAGERY
Dillard A. Larson, William H. Kuyper, and James P. Latham Sep. 1969 38 p refs
(Contract Nonr-4761(00))
(AD-694064; TR-8) Avail: CFSTI CSCL 8/2

With the increased use of aerial color photography in remote sensing, it is necessary to consider color as a critical parameter for image electronic scanning systems. The purpose of the experiment was to determine if a black and white television system can be used to differentiate and identify colors from the various signal levels which the camera generates to produce graytones in television imagery. The experiments covered a variety of color samples: ICSS/NBS Color Chips, photo transparencies, photo prints, colored paper, and films. The color standard adopted for this study was the selected ICSS/Color Chops. A high resolution IV camera, a waveform analyzer and a TV monitor were the instruments used in the experiment. The results showed that the system can discriminate most color changes in a geographic distribution. Some limitations result from the fact that more than one color value may generate the same signal level. The system can pick up and quantify density values which have interpretive significance, but complete color identification is beyond the capability of the system.
Author (TAB)

N70-15002# Army Foreign Science and Technology Center, Washington, D.C.
GROUND TEMPERATURE UNDER NATURAL AND MAN-MADE RESERVOIRS IN THE IGARKA REGION
S. G. Tsvetkova 9 Sep. 1969 40 p refs Transl. into ENGLISH from Materialy k Uch. o Merzlykh Zonakh Zemnoi Kory (Moscow), 1961 p 36–65
(AD-694578; FSTC-HT-23-247-68) Avail: CFSTI CSCL 8/6

The author proposes a new terminology for identifying swamp types. She shows how different swamp types may be identified from aerial photographs. Different tones, shapes, and structure of picture correspond to types of vegetation cover. Aerial photography alone can determine patterns of water flow and swamp formation. It may aid in showing which parts are to be explored from the ground to better advantage. Author (TAB)

N70-15031# Wisconsin Univ., Madison. Dept. of Meteorology.
A RECONNAISSANCE STUDY OF CERTAIN ASPECTS OF THE HEAT CYCLE OF LAKES Final Report 26 Dec. 1957–31 Jan. 1968
Reid A. Bryson and Robert A. Ragotzkie Aug. 1969 51 p
(Contract Nonr-1202(07))
(AD-695059) Avail: CFSTI CSCL 8/8

The basic purpose of the research was to establish the relationships between terrain, vegetation, and climate in central North America, and to gain a deeper understanding of the boreal and subarctic environment. Author (TAB)

N70-15041# Naval Research Lab., Washington, D.C. Nuclear Techniques Branch.
COSMIC RAY NEUTRONS IN THE FIRST SIX METERS BENEATH A WATER SURFACE
J. I. Hoover and C. F. Dohne *In its* Rept. of NRL Progr. Nov. 1969 p 1–4 refs (See N70-15040 04-34)
Avail: CFSTI

The neutron intensity as a function of depth in water has been measured to a depth of 6 meters by using a large BF3 proportional counter. There was a rapid attenuation of neutron intensity in the first 60 centimeters in the transition region between the atmosphere and water. From 60 to 600 centimeters the attenuation curve could not be fit with a single exponential. The measurements indicate that the value of the mean neutron absorption length (λ) is a direct function of depth. From 60 to 260 centimeters the attentuation curve can be fit with an exponential

of the form I sub x = I sub o exp (– x/L), with L = 166.5 + or – 5.4 grams per square centimeter. This is in agreement with results of other measurements in the same depth range. The increase in L with depth agrees with results of measurements in deeper water. Author

N70-15053# Army Foreign Science and Technology Center, Washington, D.C.

LOCAL SYSTEMATIC ERRORS IN AERIAL RADIO ALTITUDE DETERMINATION

N. P. Kozhevnikov 19 Sep. 1969 14 p Transl. into ENGLISH from Geodez. Kartograf. (Moscow), no. 3, Mar. 1967 p 39–44
(AD-695729; FSTC-HT-23-456-69) Avail: CFSTI CSCL 8/5

An analysis of local systematic errors in aerial radio altitude determinations in conjunction with aerial photomapping was made. The causes and extent of barometer and radio altimeter error were examined, using photogrammetric materials to check instrument readings. The investigation revealed that local systematic errors are significant. Measures are prescribed to minimize the effects of these errors during aerial photographic operations. Author (TAB)

N70-15123# Army Foreign Science and Technology Center, Washington, D.C.

THE USE OF THE RESULTS OF GEOBOTANIC INTERPRETATION OF AERIAL PHOTOGRAPHS AND THE IDENTIFICATION OF LANDSCAPE FEATURES OF TERRITORIES. LENS FORMATION OF LEAKAGE WATERS ON BLACK EARTH AND IN THE SARPINSK LOWLAND

N. N. Iordanskaya et al 10 Oct. 1969 10 p refs Transl. into ENGLISH from the Russian
(AD-695956; FSTC-HT-23-464-68) Avail: CFSTI CSCL 8/8

Aerial methods can be successfully used in finding local accumulations of water and to identify the degree of their mineralization. Preliminary interpretation of aerial photographic data makes it possible to delineate the landscapes that show the presence of shallow lenses of fresh water or weakly saline water, to determine its location and to make preliminary estimates of its quality. Author (TAB)

N70-15126# Army Foreign Science and Technology Center, Washington, D.C.

AERIAL PHOTOGRAPHY AS A METHOD FOR THE COMPLEX STUDY OF THE LANDSCAPE OF SEMI-DESERTS AND DRY STEPPES

V. A. Nikolaev et al 30 Sep. 1969 27 p refs Transl. into ENGLISH from the Russian
(AD-695723; FSTC-HT-23-507-68) Avail: CFSTI CSCL 8/6

Identification of different components of the natural medium (soils, topography, ground waters, etc.) by means of aerial photographs is possible only if there is knowledge of the intra-landscape relationships of the components. The data used successfully in the Caspian area were not suitable in the Turgay area because the former has accumulative plains while the latter has denudation plains. The whole problem of the study of the structure of landscapes is related with advances in typology and cartography of landscapes. Author (TAB)

N70-15127# Army Foreign Science and Technology Center, Washington, D.C.

MECHANISMS OF AEROSOL PARTICLE DISPERSION IN THE FREE ATMOSPHERE

G. M. Petrova et al 25 Sep. 1969 47 p refs Transl. into ENGLISH from the Russian
(AD-695511; FSTC-HT-23-530-69) Avail: CFSTI CSCL 15/2

The paper considers the dispersion in the free atmosphere of solid particles of irregular shape 100-1000 microns in diameter from altitudes of 500-8000 meters, and of spherical particles 30-100 microns in diameter from altitudes of 500-1000 meters. Luminescent particles of sand and plastic were employed as an indicator. Particle distribution on the earths surface was studied. Empirical formulas are given which permit computation of the surface concentration of particles which have fallen from an instantaneous point source in a specific distribution according to descent velocity, depending on the altitude of the source and average land velocity. An analysis of the dispersion factors of impurities settling in the atmosphere is given. Author (TAB)

N70-15134# Army Foreign Science and Technology Center, Washington, D.C.

EXPERIMENTAL WORK ON ANALYTICAL PHOTOTRIANGULATION

N. S. Boikova 19 Sep. 1969 14 p Transl. into ENGLISH from Geodez. Kartograf. (Moscow), no. 3, Mar. 1967 p 34–38
(AD-695730; FSTC-HT-23-457-69) Avail: CFSTI CSCL 8/5

Experimental work is analytical phototriangulation with the aid of the M-20 electronic computer has been conducted since 1964 in air enterprise of the Geodesy and Cartography Directonate. The analytical method is compared to the universal method; results confirm the wisdom of introducing the analytical system on a wide scale, although work remains to be done in increasing the output of special stereo comparators aid in improving the quality of aircraft photography. Author (TAB)

N70-15148# Army Foreign Science and Technology Center, Washington, D.C.

USE OF AERIAL METHODS FOR STUDYING ZONAL AND REGIONAL LANDSCAPE PATTERNS

V. P. Miroshnichenko 12 Sep. 1969 83 p refs Transl. into ENGLISH from the Russian
(AD-695724; FSTC-HT-23-531-68) Avail: CFSTI CSCL 8/6

The science of landscapes in the USSR is a special branch of geography integrating data on soils, hydrography, topography, climate, vegetation and other fields of natural phenomena in their overall interrelationships. Aerial photography has not yet been used in this work and landscape science has accordingly suffered. Aerial methods must be used if science is to advance. Over all assessments of regions and natural zones are essential in the USSR, where vast areas are still unexploited or where more effective exploitation is necessary for development of the national economy. The author gives a number of specific examples showing the effectiveness of the use of aerial photography in landscape studies. This is followed by a review of the authors proposals for coverage of the country by a system of geographic reference profiles running east to west and north to south across the entire Soviet Union, which could serve as a basis for making more detailed landscape studies. Author (TAB)

N70-15151# Lockheed Missles and Space Co., Sunnyvale, Calif.

LIGHT REGIME IN DEEP LAYERS OF A TURBID MEDIUM WITH STRONGLY ELONGATED SCATTERING INDEX

V. M. Loskutov 27 Sep. 1968 8 p refs Transl. into ENGLISH from Vestnik Leningrad Univ., (Russian), no. 13, 1969 p 143–149
Avail: CFSTI

A continued fractions method for computing the light regime in deep layers of a semi-infinite plane-parallel medium is presented. It is assumed that direct radiation from external sources does not reach these layers, that diffuse radiation plays the most significant role, and that the radiation intensity is independent of the azimuth in these layers. Utilization of continued fractions permits easy calculations of the light regime in deep layers of a turbid medium having a strongly elongated scattering index. Approximate and exact values of coefficients for the case of almost pure scattering, when the absorption in the volume element is slight, are compared and show that the approximate formulas provide almost exact results. M.H.E.

N70-15158# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
ON THE DETERMINATION OF THE VERTICLE GRADIENT OF THE TERRESTRIAL ACCELERATION OF THE GEOIDAL EARTH [PRO VIZNACHENNYA VERTICALNOGO GRADIENTA ZEMNOGO PRISKORENNYA GEOIDALNOI ZEMLI]
I. F. Monin Sep. 1969 8 p refs Transl. into ENGLISH from Akad. Nauk URSR, (Kiev), no. 7, 1965 p 893–896
(AD-694584; ACIC-TC-1510) Avail: CFSTI CSCL 8/5

The vertical anomalous gradient of gravity is calculated from gravity anomalies. In addition, the earth is considered as an infinite area, or a sphere, or a bi-axial ellipsoid, or finally a geoid. All the formulas for the partial derivative of delta g with respect to nut are integral. The most interesting formula has been suggested by M. S. Molodenskiy. A new formula for the partial derivative of delta g with respect to nu is presented in this report, which gives the possibility to calculate the vertical gradient of gravity more accurately by one order than Molodenskiy's formula. TAB

N70-15160 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 93, NO. 4: DAILY GROUND AND 850 mb MAPS FOR THE NORTHERN HEMISPHERE DURING THE YEAR 1968 [METEOROLOGISCHE ABHANDLUNGEN. BAND 93, HEFT 4: TAEGLICHE BODEN- UND 850 MB KARTEN DER NORDHEMISPHAERE IM JAHRE 1968. TEIL 4, 4. VIERTELJAHR] Quarterly Report, Part 4
Manfred Gab and Richard Scherhag 31 Dec. 1968 376 p In GERMAN
(QR-4-Pt-4) Avail: CFSTI

Presented is a collection of Northern Hemisphere weather maps that demonstrate daily ground level and 850-mb characteristics of the earth atmosphere. Observations were made during the period October 1st through December 31, 1968. Transl. by G.G.

N70-15161# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Physik.
METEOROLOGICAL DATA. VOLUME 105, NO. 1: BERLIN READINGS. DIGITAL AND ANALOG RESULTS FROM THE CENTRAL MEASUREMENT REGISTRATION INSTALLATION AND OTHER INSTRUMENTS DURING THE YEAR 1969 Quarterly Report, Part 1 [METEOROLOGISCHE ABHANDLUNGEN. BAND 105, HEFT 1: DIGITALE UND ANALOGE ERGEBNISSE DER ZENTRALEN MESSWERTREGISTRIERANLAGE UND WEITERER INSTRUMENTE FUER DASJAHR 1969. Stell 1, 1. Vierteljahr]
Richard Scherhag and Erich Wedler 31 Mar. 1969 380 p refs In GERMAN
(QR-1-Pt-1) Avail: CFSTI

Climatological-statistical tables presented contain daily as well as weekly automatic registration data. Meteorological observations range from the various atmospheric indices to measurements of radioactivity and sunshine duration. Transl. by G.G.

N70-15162# Isotopes, Inc., Westwood, N.J.
CORRELATION BETWEEN GEOMAGNETIC MICROPULSATIONS AND IONOSPHERIC DOPPLER CHANGES Interim Technical Report
Hernan A. Montes and Thomas J. Herron Aug. 1969 28 p refs
(Contract F44620-69-C-0038; ARPA Order 1316)
(AD-694587; IWL-7556-156; AFOSR-69-2226-TR) Avail: CFSTI CSCL 4/1

Observations of geomagnetic micropulsations, Doppler frequency variations and infrasonic activity were conducted during the summer of 1968. Spectral and polarization analyses of a typical event in which there was high correlation between Doppler variations and geomagnetic micropulsations are reported. No infrasonic activity associated was found, leading to the conclusion that this type of association has a hydromagnetic origin. Author (TAB)

N70-15222*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APPLICATION OF SPACE PHOTOGRAPHS FOR GEOMORPHOLOGICAL STUDY: TAURUS MOUNTAINS, TURKEY Technical Letter
Yehuda Kedar Aug. 1969 8 p refs
(NASA-TM-X-62571; TF7-1) Avail: CFSTI CSCL 08F

The potentialities of space photographs are considered for analysis of the geomorphology of an area which has been mapped with detailed geological information. The area under discussion is the central part of the Taurus Mountains and the southern part of central Anatolia. This area is analyzed and divided into geomorphological units. The major discussion concerns the function of the space photographs in the geomorphological study. Author

N70-15392*# Texas Univ., Austin. Dept. of Civil Engineering.
BEHAVIOR OF SOILS UNDER IMPACT LOADING
Paul A. Hustad and William R. Cox Jul. 1969 226 p refs
(Grant NsG-604)
(NASA-CR-66881) Avail: CFSTI CSCL 08M

The space exploration program of the United States has created a need for a better understanding of how soils behave under impact loading. Approximately 175 impact tests were performed. The rigid projectiles consisted of wedges, cylinders, spheres, and cones. The projectile weights varied from approximately 40 to 130 lbs. The angle of projectile impact varied between 10 and 90 degrees from the horizontal soil surface. Horizontal and vertical components of the impacting velocities ranged from 0 to 20 fps and 10 to 30 fps, respectively. Approximately 50 impact tests were conducted for the purpose of evaluating projectile edge effect equations and soil pressure equations. A comparison study of the peak soil forces developed during impact and the forces obtained from static load tests indicated that the ratios of peak impact forces to static forces were approximately 2.5 for tests on silt and clays. The force ratios for tests on sands were in most cases well over 100. A review of the effect of load application rate upon the soil strength properties of cohesion and of angle of internal friction, and a discussion of failure modes occurring beneath dynamically loaded footings are also presented. Author

N70-15404*# Bureau of Mines, Minneapolis, Minn. Twin Cities Mining Research Center.
MULTIDISCIPLINARY RESEARCH LEADING TO UTILIZATION OF EXTRATERRESTRIAL RESOURCES Quarterly Status Report, 1 Jul.–1 Oct. 1969
Thomas C. Atchison 1 Oct. 1969 18 p
(NASA Order R-09-040-001)
(NASA-CR-107552) Avail: CFSTI CSCL 08G

Progress in simulated lunar environment investigations of surface properties of rock, rock failure processes and strength and elastic properties, thermal fragmentation and thermophysical and optical properties, and fine particle behavior is summarized. Other tasks discussed are the use of explosives on the moon, and electrowinning of oxygen from silicate rocks. J.M.C.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-14109# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SELECTION OF THE LENGTH OF A THERMOCOUPLE FOR MEASURING INSTANTANEOUS TEMPERATURE IN NONSTATIONARY GAS FLOWS

I. P. Pelepeichenko et al 19 May 1969 9 p refs Transl. into ENGLISH from Kontroln.-Izmeritelnaya Tekhn. (USSR), no. 5, 1968 p 79 - 82

(AD-694853; FTD-HT-23-157-69) Avail: CFSTI CSCL 14/2

When designing a thermocouple for measuring the temperature in an unsteady gas flow, the length of the thermocouple is very important. In the present study, the transitional process of a thermocouple with a specific length and diameter made from a thin wire with a junction in the middle was investigated. The investigation showed that at the very beginning of the transition process both thermocouples (one with a finite length and the other with infinite length) show the same temperature. Author (TAB)

N70-14128*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

GLOBAL TIMING SYSTEMS OF NANOSECOND ACCURACY USING SATELLITE REFERENCES

E. F. Osborne Oct. 1969 193 p refs

(Grant S-5051 AG)

(NASA-CR-107317; TG-1086) Avail: CFSTI CSCL 14B

The application of artificial satellites to provide radio reference signals for the synchronization and calibration of local clocks and timing systems has been studied. Space technologies in the specific areas of geodesy and navigation are applied with digital signaling techniques and atomic time and frequency standards. A useful operational service can be provided on a global basis with a low altitude polar satellite having an on-board atomic clock to most effectively satisfy user requirements at various levels of system accuracy. For fixed site users, system accuracies as good as 100 nanoseconds (rms) are realistic with sophisticated equipment and data processing. Author

N70-14129*# Old Dominion Coll., Norfolk, Va. School of Engineering.

STATISTICAL ANALYSIS OF A PLANETARY RADAR ALTIMETER MEASURING UNIT

William D. Stanley and Wayne R. Powell Sep. 1969 58 p refs

(Grant NGR-47-003-015)

(NASA-CR-66784; TR-69-101) Avail: CFSTI CSCL 14B

Statistical analysis of the altitude measuring unit of a proposed lightweight AM-CW radar altimeter is presented. The mathematical model was obtained by assuming a finite number of statistically independent samples during a period, which is related to the required transmission bandwidth. The mathematical model was readily implemented on an IBM 1130 computer. The analysis was first performed with Gaussian statistics in order to verify the validity of the model by comparison with experimental data taken under similar conditions. The results obtained showed excellent correlation between experimental and computer results. The analysis was then performed with Rayleigh statistics in order to predict the expected performance of an RF unit with a linear envelope detector. A compilation of data indicating the expected performance of the unit under a wide range of operating parameters is presented. Author

N70-14130*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN AND PERFORMANCE OF A DIGITAL ELECTRONIC NORMAL SHOCK POSITION SENSOR FOR MIXED-COMPRESSION INLETS

Gary L. Cole, George H. Neiner, and Michael J. Crosby Washington Dec. 1969 29 p refs

(NASA-TN-D-5606) Avail: CFSTI CSCL 14B

The shock sensor described gives a direct indication of a normal shock position by sensing minimums in the cowl surface static pressure profile. Minimums are determined from outputs of electronic pressure transducers connected to static pressure taps in the inlet throat by means of analog and electronic digital logic elements. Statically the sensor indicates shock position correctly within the spacing of the taps. The sensor response to sinusoidal shock motions of frequencies from 1 to 65 Hz was tested. The results show that the sensor's response is within 10 percent of actual shock amplitude with a phase lag of not more than 18 deg over the test frequency range. Author

N70-14132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.

ADDITION OF A GAMMA RAY SPECTROMETER TO THE ALPHA SCATTERING EXPERIMENT AS DESIGNED FOR THE SURVEYOR MISSION

Albert E. Metzger and Timothy M. Harrington 1 Nov. 1969 22 p refs Prepared jointly with Analog Technology Corp.

(Contract NAS7-100)

(NASA-CR-107314; JPL-TR-32-1423) Avail: CFSTI CSCL 14B

Gamma ray spectroscopy and alpha scattering are separate techniques that can be used for the compositional analysis of lunar and planetary surfaces. It is possible to combine a gamma ray spectrometer with an alpha scattering instrument in a relatively simple manner, so that they can operate sequentially while sharing much of the electronics. The interfaces which have been designed and tested are based on the alpha scattering instrument that performed successfully in the Surveyor program. Author

N70-14198*# Time-Zero Corp., Torrance, Calif.

ALSEP/SIDE/CCGE (APOLLO LUNAR SURFACE EXPERIMENTS PACKAGE/SUPRATHERMAL ION DETECTOR EXPERIMENT/COLD CATHODE GAUGE EXPERIMENT). VOLUME 1 Final Engineering Report

R. A. Rivas and Sam Pollack [1969] 247 p Prepared for Rice Univ.

(Contract NAS9-5911)

(NASA-CR-102048) Avail: CFSTI CSCL 14B

The Suprathermal Ion Detector Experiment/Cold Cathode Gauge Experiment (SIDE/CCGE) was designed and fabricated by Marshall Laboratories as an integral part of the Apollo Lunar Surface Experiments Package (ALSEP). The SIDE/CCGE Experiment will measure the flux, number density, velocity and energy per unit charge of positive ions in the vicinity of the lunar surface and transfer such information to the ASLEP Data Subsystem. A Low Energy (LE) detection system, consisting of a Wein Velocity selector (crossed electric and magnetic fields), an electrostatic analyzer, and a Channeltron (R) Electron Multiplier, detects positive ions with masses up to 130 AMU, and measures the differential energy spectrum of ions in a narrow velocity range having energies from 0.2 ev to 48.6 ev per unit charge. The CCGE experiment will determine the density of any lunar ambient atmosphere corresponding to pressures of .000001 torr to approximately 10 to the minus 12th power torr, including any temporal variations either of a random character or associated with lunar local time or solar activity. Author

N70-14199*# Time-Zero Corp., Torrance, Calif.

ALSEP/SIDE/CCGE (APOLLO LUNAR SURFACE EXPERIMENTS PACKAGE/SUPRATHERMAL ION DETECTOR EXPERIMENT/COLD CATHODE GAUGE EXPERIMENT). VOLUME 2: APPENDIX Final Engineering Report

R. A. Rivas and Sam Pollack [1969] 251 p Prepared for Rice Univ.

(Contract NAS9-5911)

(NASA-CR-102047) Avail: CFSTI CSCL 14B

For abstract see N70-14198

N70-14211*# Foster-Miller Associates, Inc., Waltham, Mass. Electronics Research Center.
DEVELOPMENT OF OPTIMUM CLAMP COMBINATIONS FOR STRAP-DOWN INERTIAL MEASURING UNITS WITH FIELD REPLACEABLE SENSORS
John S. Howland, Seth R. Goldstein, and Dikrun Der Marderosian Sep. 1968 218 p refs
(Contract NAS12-591)
(NASA-CR-86284) Avail: CFSTI CSCL 14B

This report presents the results of an analytical design study of the factors involved in mounting normalized inertial gyroscopes and accelerometers to an inertial sensing unit so that alignment is ensured without field adjustment. Factors studied include interface conditions such as surface roughness, dirt, films, wear, foreign material, dimensional stability, mechanical and thermal loads, and clamp configurations. Author

N70-14223# Honeywell, Inc., St. Paul, Minn. Systems and Research Div.
AIR-LAUNCHED WINDSONDE
Stephen F. Rohrbough and Lyle E. Koehler Jul. 1969 50 p refs
(Contract AF19(628)-6082)
(AD-695121; SR-1; AFCRL-69-0397) Avail: CFSTI CSCL 4/1

The design, development, and first phase of the testing of a wind measuring instrument are described. The device was required to obtain a vertical profile of winds to sea level after being released from an aircraft at 30,000 feet. An arrow-shaped, low wind-drift sonde was selected that used an airbearing gyroscope and magnetic field sensor to measure data that yielded wind shear. This information was then integrated to obtain wind velocity. The results of the balloon-launched phase of the field tests indicated that the sonde does respond to the wind and that the second test phase involving aircraft deployment of the sondes should be undertaken. Author (TAB)

N70-14248*+ Eastman Kodak Co., Rochester, N.Y. Apparatus and Optical Div.
APOLLO LUNAR SURFACE CLOSE-UP CAMERA Final Report
[1969] 230 p
(Contract NAS9-9094)
(NASA-CR-102039; M-001038-RU) Avail: CFSTI CSCL 14E

The design, construction, and simulation testing of the Apollo Lunar Surface Close-up Camera (ALSCC) is presented. Failure reports, and failure analyses are included. The ALSCC hardware is described, including: (1) lens selection and testing, (2) film transport mechanism, (3) shutter assembly, (4) camera case assembly, (5) pole and handle assembly, (6) vibration isolator support, and (7) electrical section. F.O.S.

N70-14253# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CENTRAL AERIAL CAMERA SHUTTERS OF STRIP TYPE
N. P. Zakaznov et al 10 Apr. 1969 18 p refs Transl. into ENGLISH from Tr. Inzh. Geod., Aerofotosemki i Kartografii (Moscow), no. 39, 1960 p 15–24
(AD-694873; FTD-HT-23-1294-68) Avail: CFSTI CSCL 14/5

The article describes layouts for aerial camera shutters of the strip type. Calculation of a strip shutter is given as an example. The following advantages of shutters of this type are cited. Lenses with small interlens distance can be used short exposure times simplicity and reliability of slot synchronization avoidance of the need to separate the lens into two sections when the shutter is assembled, so that only a narrow slot in the lens mount is needed to set the strip. TAB

N70-14309# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE PERFORMANCE OF SILICON STRAIN GAGES ON ALTERNATING CURRENT UNDER STATIC AND DYNAMIC CONDITIONS
A. V. Sandulov, R. A. Pelenskii, I. I. Maryamova, and Yu. N. Zaganyech 30 Jan. 1969 10 p refs Transl. into ENGLISH from Poluprov. Tekhnika I Mikroelektronika Resp. Mezhvedomstvennyi Sb., (Russian), no. 2, 1967 p 23–29
(AD-695329; FTD-T-23-688-68) Avail: CFSTI CSCL 14/2

The operation of a strain gage based on silicon strain transducers and operating under a-c static or a-c dynamic conditions is described. The transducers used are p-type silicon crystals with either gold or platinum leads soldered to the crystal sides to obtain ohmic contacts. In order to obtain a linear dependence of strain gage output signal on changes in transducer resistance caused by strain, a difference circuit is used for the strain gage. The strain gage output is expressed by an equation in the text. The strain gage was tested under both static and dynamic operating conditions; the strain sensitivity of the silicon transducers was found to be independent of frequency in the 50Hz--50kHz range. A better linear dependence of the output signal on the transducer resistance change was obtained by using the difference circuit described than could have been obtained if a d-c bridge circuit had been used. TAB

N70-14320# California Univ., Livermore. Lawrence Radiation Lab.
GAS CHROMATOGRAPHIC ANALYSES FOR LOW CONCENTRATIONS OF FEFO
E. N. Sanborn *In its* Hazards Control Dec. 1968 p 51–53
Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

A method was developed to determine 10 to the minus 9th power g of bis(2,2-dinitro-2-fluoroethyl)formal (FEFO) in work areas. The instrument used is an Aerograph 1520 with an electron capture detector. Author (NSA)

N70-14322# California Univ., Livermore. Lawrence Radiation Lab.
ENERGY DEPENDENCE CHARACTERISTICS OF THE NEW LRL PERSONNEL DOSIMETER
B. G. Samardzich *In its* Hazards Control Dec. 1968 p 59–64
Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

The energy dependence of the new LRL lithium fluoride thermoluminescent personnel dosimeter for gamma and x radiation is discussed. Author (NSA)

N70-14425*# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
THE OGO-2 NEUTRAL AND ION MASS SPECTROMETER EXPERIMENT
R. J. Leite, B. B. Hinton, and C. J. Mason Oct. 1969 15 p refs
(Contract NAS5-3098)
(NASA-CR-107408; Rept-05465-1-F) Avail: CFSTI CSCL 14B

The experiment is described from the data processing point of view. A brief description of the quadrupole spectrometer is given. The approach to data processing is reviewed and related to the OGO-II data. A brief review of the spacecraft malfunctions and their influence upon the experiment is included. The only significant data obtained indicated that large spacecraft probably expell large amounts of water vapor over extended periods of time and precautions should be taken to prevent damage to instruments and degradation of their data. Author

N70-14450# Army Foreign Science and Technology Center, Washington, D.C.

A MICROWAVE HELIUM NOISE GENERATOR

Kh. V. Khinrikus et al 18 Sep. 1969 25 p refs Transl. into ENGLISH from Tr. Metrologicheskikh Inst. (USSR), no. 90(150)

(AD-694583; FSTC-HT-23-445-69) Avail: CFSTI CSCL 14/2

The authors describe a helium noise generator for the X-band. They describe a method of calculating noise temperature output in the case of helium temperatures and centimeter wave lengths. The method is given of calibrating a helium noise generator. TAB

N70-14457# Army Electronics Command, Fort Monmouth, N.J. Inst. for Exploratory Research.

AUTOMATIC DIGITAL READOUT SYSTEM FOR POLAROID CAMERAS

Johann J. Kainz and Irwin M. Gumeiner Aug. 1969 24 p refs

(AD-695651; ECOM-3169) Avail: CFSTI CSCL 14/2

Design, construction and performance of a digital readout system for photographic oscilloscope records are discussed. Electromechanical parts, commando logic and optical elements are described in detail and relevant parts of the system analysis are presented. Author (TAB)

N70-14461# California Inst. of Tech., Pasadena. Div. of Engineering.

HOLOGRAPHY AND STEREOSCOPY

Nicholas George and J. T. Mc Crickerd Jul. 1969 33 p. refs Presented at Ann. Conf. on Phot. Sci. and Eng., Los Angeles, 12 – 16 May 1969 Revised

(Grant AF-AFOSR-68-1492)

(AD-695182; AFOSR-69-1466-TR) Avail: CFSTI

The holographic stereogram (HS) consists of an ensemble of juxtapositioned transform-holograms made from photographic transparencies of a scene. The viewer looks into the HS, as with a conventional hologram, and sees a virtual image reconstruction accurately rendering the object space. In this treatment the two basic types are reviewed: one using a single exposure with a flys-eye lens and the other a temporal sequence of photos. Their conceptual relationship to Lippmanns integral photograph and Gabors hologram is explained. Analyses are presented of scaling and resolution for the sequential type of HS. Up and down scaling as well as vertical exaggeration can be controllably obtained. Using a simple Gaussian beam analysis, a formula for the angular resolution of the HS is found. Author (TAB)

N70-14463# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.

ON ELECTROSTATIC ENERGY ANALYZERS FOR CHARGED PARTICLES [UEBERLEGUNGEN ZU ELEKTROSTATISCHEN ENERGIEFILTERN FUER GELADENE TEILCHEN]

K. Wilhelm and M. Schnell Munich Bundesministerium fuer Wiss. Forsch. May 1969 41 p refs In GERMAN; ENGLISH summary

(BMwF-FB-W-69-21) Avail: CFSTI CSCL 14B

The properties of cylindrical curved plate analyzers have been examined in order to clarify the possibilities of their application for particle energy spectrometers aboard sounding rockets and satellites. Solutions of the non-relativistic equations of motion in the electric field are given with the aid of an analogue computer. Trajectories of the particles are shown for a special ratio of the plate radii as function of the starting point, the angle of incidence and the energy. The results have been used to design and compare three particle spectrometers. Author

N70-14472# Air Force Systems Command, Edwards AFB, Calif. Rocket Propulsion Lab.

PROJECT PYRO DYNAMIC PRESSURE ACCURACY EVALUATION Final Technical Report, Aug. 1967 – Aug. 1968

Charles M. Richey Jun. 1969 77 p refs

(AD-693566; AFRPL-TR-68-111) Avail: CFSTI CSCL 14/2

An accuracy study was performed on the pressure measurement instrumentation of Project Pyro (Blast Hazards Testing) located at Test Area 1-90 at the Air Force Rocket Propulsion Laboratory (AFRPL), Edwards AFB, California. This report presents the methods, techniques, problems, results, and conclusions of this accuracy study. A pseudo end-to-end technique was employed to obtain the data with the results being presented to a 95% confidence level. Author (TAB)

N70-14474# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TENSOMETRIC METHOD OF MEASURING THE COMPRESSIBILITY OF METALS UP TO 2.5 TIMES 10 TO THE 9TH POWER N/m SQUARED (25000 BAR)

A. R. Kutsar 21 Apr. 1969 8 p refs Transl. into ENGLISH from Tsentr. Nauchn.-Issled. Inst. Chernoi Met., Sb. Trudov (Moscow), no. 55, 1967 p 130 – 132

(AD-694852; FTD-HT-23-1476-68) Avail: CFSTI CSCL 14/2

A strain gage mathod developed for measuring the isothermal compressibility of metals up to 25,000 bars is described. The coefficient of compressibility was determined from the change of volume with pressure. Since the coefficient of compressibility ranges in value, experimental measurements were difficult. Resistance strain gages were bonded to polycrystalline samples of aluminum, titanium, copper, nickel, and bismuth, and the samples were subjected to fluid pressure. A differential method was used to obtain the differences in volume as a function of pressure; iron was used as a standard. A formula for the changes in volume as a function of the change of length of the strain gage is given. Data are presented for all the metals for pressures ranging from 5000 to 25,000 bars at intervals of 5000 bars. Author (TAB)

N70-14495*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.

DESIGN AND CALIBRATION OF FAR-UV PHOTOMETERS FOR ROCKET USE

C. B. Opal May 1969 22 p refs

(Grant NGR-21-001-001)

(NASA-CR-107407; TR-19) Avail: CFSTI CSCL 14B

The relative merits of anode-signal processing by photon counting and current measuring techniques are discussed. The advantages of photon counting, as applied to G-tubes are considered to be: (1) nearly two-fold improvement in signal-to-noise ratio, (2) more convenient processing of low-level signals on analog telemetry channels and direct compatibility with digital telemetry systems, (3) greatly reduced sensitivity to changes in tube operating conditions, (4) elimination of zero drift, and (5) compatibility with operation of the cathode at ground potential. The advantages of current measuring are also presented and a rocket photometer system implementing the photon counting method is described. Author

N70-14529# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TURBULENT TANGENTIAL STRESS AND DISSIPATION OF TURBULENT ENERGY IN THE LOWER TWO-METER LAYER OF THE ATMOSPHERE

N. M. Galadzhii 25 May 1969 17 p refs Transl. into ENGLISH from Tr. Ukr. Nauchn.-Issled. Inst. Gidrometeoro. (Kiev), no. 62, 1968 p 139 – 146

(AD-695932; FTD-MT-24-96-69) Avail: CFSTI CSCL 14/2

The article covers methods and principles of operating of instruments for direct measurement of tangential turbulent stress. On the basis experimental data are given dependencies of turbulent tangential stress on thermal stratification and wind velocity, plus dependencies of the rate of viscous dissipation and dimensions of vortexes responsible for viscous dissipation on height. Author (TAB)

N70-14562# Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Research Labs.
STRAIN GAGE INSTRUMENTATION FOR A LIGHT GAS GUN
P. D. Flynn May 1969 13 p refs Presented at 3rd IEEE Intern. Congr. in Aerospace Simulation Facilities, Farmingdale, N.Y., 5 8 May 1969 Submitted for publication
(AD-693790; FA-A69-2) Avail: CFSTI CSCL 14/2

Variable-resistance strain gages were used to study the operating characteristics of a light-gas gun. Gages were cemented on the outer surface of the gun at several locations, in order to determine chamber pressure, piston velocity, and pressures in the central breech. The high-pressure transition section deformed plastically in most rounds, and a method is suggested for estimating maximum pressures from strain-time records. Results are given for various helium pressures and powder charges. Author (TAB)

N70-14572*# Battelle Memorial Inst., Richland, Wash.
STUDY OF INTERACTION OF LOW DOSE POWER SOURCE RADIATION FIELDS WITH SELECTED SPACE SCIENTIFIC INSTRUMENTS Quarterly Progress Report
A. J. Haverfield and G. W. R. Endres 12 Dec. 1969 23 p Prepared for JPL
(Contracts NAS7-100; JPL-952559)
(NASA-CR-107447; Y-49607) Avail: CFSTI CSCL 14B

The electronic setup for the scintillation neutron spectrometer is given in some detail with a complete block diagram. Measurements taken with the spectrometer before component failure are discussed. Preliminary measurements with the totally depleted surface barrier detectors are shown along with the calibration results obtained with a Po-210 alpha source. Details of several Be(d,n) neutron exposures are shown with neutron energy yields as a function of deuteron bombardment energy. Author

N70-14592# Stanford Univ., Calif. High Energy Physics Lab.
ON THE DESIGN OF NaI(Tl) TOTAL ABSORPTION DETECTORS FOR STRONGLY INTERACTING PARTICLES AT GEV ENERGIES
E. B. Hughes, R. Hofstadter, W. L. Lakin, and I. Sick Jan. 1969 26 p refs
(Contract Nonr-225(67))
(AD-695418; HEPL-592) Avail: CFSTI CSCL 18/4

The properties of a large NaI(Tl) detector as a total absorption detector for pions at GeV energies are reported. These observations are supplemented by measurements on the three-dimensional distribution of deposited energy in a large absorber of metallic tin by 8 GeV pions. The latter data are compared with existing Monte Carlo calculations of the nucleon-meson cascade and their application to the design of total absorption detectors with large containment factors is discussed. Author (TAB)

N70-14712*# Ewen Knight Corp., East Natick, Mass.
DESIGN OF A SATELLITE INSTRUMENT FOR MEASUREMENT OF THE MILLIMETER CHARACTERISTICS OF ATMOSPHERIC OZONE Final Report
[1969] 124 p refs
(Contract NAS12-117)
(NASA-CR-86295) Avail: CFSTI CSCL 14B

The design approach for a satellite measurement instrument capable of detecting atmospheric ozone concentration and motion was investigated to develop detailed knowledge of the global vertical temperature distribution, water vapor concentration pressure gradients and the structure of air mass flow for numerical weather prediction. The objective was to select an ozone resonant line with sufficient intensity to be detected with a signal-to-noise ratio adequate to allow resolution of the line profile to the precision required for inversion. It is concluded that the Taylor Radiometric Mode, which eliminates the need for ferrite devices and couplers in the input signal transmission line will provide an overall improvement of 10 db in sensitivity over the Earth Bound Instrument. F.O.S.

N70-14741# Atomic Energy Commission, New York.
RADIOMETRIC APPARATUS FOR DETERMINING SR-90 CONTENT OF SEA WATER
S. M. Vakulovskii et al *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 157 162 refs (See N70-14726 04-04)
(A-AC-82/G/L-1259) Avail: CFSTI

In order to measure the content of Sr-90 separated from 2 to 10 l of seawater, sensitive radiometric equipment was developed. The equipment consists of a scintillation-type beta-spectrometer, in which for reducing background, a combined detector of the Phoswitch type was used. The detector consists of a monocrystal of naphthalene with a diameter of 25 mm and a height of 20 mm, to the end surface of which there was glued a disk made of scintillating plastic on the base of polyvinylxylol. Two detectors, mounted on two photoelectronic multipliers of the type FEU-53, were used to form the telescopic system. The proposed device has a sensitivity exceeding by several times the sensitivity of the best known installations. NSA

N70-14752# College de France, Paris. Laboratoire de Physique Nucleaire.
COCCINELLE: A DEVICE FOR AUTOMATIC PATTERN RECOGNITION AND EVENT MEASUREMENT ON BUBBLE CHAMBER PHOTOGRAPHS
B. Equer, C. Guignard, G. Reboul, and A. Volte *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 6–21 refs (See N70-14751 04-08)
Avail: CFSTI

The principle of the coccinelle system which is based on analysis of bubble chamber photographs by successive approximations and is to be used mainly for scanning simple and frequent topologies is discussed. The design and operating characteristics of the device are examined including spot generation, operating modes, control logic and computer connections, and correlation network. The strategy of the event recognition program is outlined. The state of the project is also briefly reported. (NSA)

N70-14753# Harvard Univ., Cambridge, Mass. Dept. of Physics.
SPASM: A PROGRAMMED CRT PRECISION SCANNING AND MEASURING SYSTEM
A. E. Brenner, P. deBruyne, B. J. Reuter, L. K. Sisterson, and C. A. Bordner, Jr. *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 22–39 refs (See N70-14751 04-08)
(Contract AT(30-1)-2752)
Avail: CFSTI

The spark chamber photograph automatic scanning and measuring (SPASM) is described. The system was originally designed for wide gap spark chamber photographs with an additional capability of handling bubble chamber film. The SAPSM logic unit generates a vector of variable length and direction and is controlled by a time-shared PDP1 computer. The scanning hardware evolved from a very simple SPASS like device and incorporates ideas from the PEPR development. R.B.

N70-14754# Illinois Univ., Urbana.
THE UNIVERSITY OF ILLINOIS DOLLY SYSTEM
Richard M. Brown and Robert W. Downing *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 40–47 (See N70-14751 04-08)

Avail: CFSTI

The DOLLY system, a modified version of POLLY, for bubble chamber film scanning is described. Unique features of the system include a multiple CRT/film drive, larger scanning aperture, digital distortion corrections and slice scanning, and slice segment alignment and curvature. The film transport and CRT modules are located at the end opposite from the operator's console to allow sufficient optical path for the protection to the console. The estimated costs of the system are outlined. R.B.

N70-14757# Wisconsin Univ., Madison.
THE HARDWARE OF SATR
Murray A. Thompson *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 81–101 Supported by AEC (See N70-14751 04-08)
Avail: CFSTI

The SATR three-dimensional bubble chamber photograph analysis system is examined. The advantages of a three-dimensional analysis system are listed. The hardware for the SATR system is described, including the external 3D recognition hardware, and other circuit designs. NSA

N70-14760# European Organization for Nuclear Research, Geneva (Switzerland).
FULL GUIDANCE MEASUREMENTS WITH THE CERN HPD2
W. M. R. Blair *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Process. for Spark and Bubble Chambers Jan. 1969 p 130–139 refs (See N70-14751 04-08)
Avail: CFSTI

The present situation of the CERN full guidance (or road guidance) system for the measurement of bubble chamber film is summarized. NSA

N70-14768# Brookhaven National Lab., Upton, N.Y.
LARGE DIGITIZED SPARK CHAMBER SPECTROMETER AND ON-LINE COMPUTER SYSTEMS
S. J. Lindenbaum *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 202–225 refs Sponsored by AEC (See N70-14751 04-08)
Avail: CFSTI

A new Double V Magnetic Spectrometer System is described which contains two multiparticle detecting magnetic spectrometer arms, utilizing spark chamber hodoscopes with automatic digitization of spark location by magnetostrictive readout digitized by scaler readings. The system is designed for the automatic detection and measurement of the momenta of the charged decay particles from double vertex events. The raw data is handled by a local data handler which stores the data in a local computer memory and between AGS pulses sends a preselected sample to the PDP 6 computer system of the On-Line Data Facility. R. B.

N70-14773# California Univ., Berkeley. Lawrence Radiation Lab.
DAPR: VERTEX SEARCH AND TRACK MATCH
Dennis Hall *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 299–305 (See N70-14751 04-08)
Avail: CFSTI

A brief description of the vertex finding and track matching procedures used by the DAPR program is given. Vertex searching is accomplished by finding in each view all clusters of tracks whose ends are near the common intersection point of their descriptive circles. These view-vertices are spatially matched to associate clusters in the three views. Tracks of spatially matched clusters are compared to produce for each track in space the list of corresponding image tracks in each view. The algorithms used stress speed of decision. The comparison between views is a powerful tool used to clean up ambiguities unresolvable in individual views. Author

N70-14775# European Organization for Nuclear Research, Geneva (Switzerland).
EXPERIENCE AT CERN OF THE AUTOMATIC MEASUREMENT OF SPARK CHAMBER PICTURES
T. F. Andersson, R. A. Bowen, H. E. Davies, S. Lauper, M. B. Metcalf et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 310–316 refs (See N70-14751 04-08)
Avail: CFSTI

The present status of spark chamber film measurement techniques is reviewed and new techniques which are likely to be the most important in the next few years are discussed. NSA

N70-14777# European Organization for Nuclear Research, Geneva (Switzerland).
DEVELOPMENTS IN THE EVALUATION OF MAGNETIC FIELD SPARK CHAMBER PICTURES
J.-C. Lassalle and P. Zanella *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 328–343 refs (See N70-14751 04-08)
Avail: CFSTI

Two new developments associated with pattern recognition and data handling in the operation of an optical spark chamber in a magnetic field are discussed. The first is the use of a CRT display and light pen to speed up the inspection and recovery of events which have not been recognized by the normal pattern recognition programs. The second is the approval of the Omega project for the construction at CERN of a large aperture spectrometer magnet. A system of spark chambers will be operated inside the magnet and the project includes a dedicated data handling system capable of processing both the film and wire chamber information that will be produced. NSA

N70-14779# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics.
IONIZATION MEASUREMENTS OF BUBBLE CHAMBER TRACKS WITH THE TELEVISION MEASURING PROJECTOR
G. Yekutieli, R. Yaffe, and S. Tosff *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 353–361 refs (See N70-14751 04-08)
Avail: CFSTI

Results on ionization measurements of bubble chamber tracks, with the Television Measuring Projector are reported. The ionization is measured up to 4 × minimum with relative error of less than 20%. Protons and pions can be identified and separated up to 1.5 GeV/c. The ionization measurements are used, with the help of the ionization test, to choose the correct hypothesis of bubble chamber events, with 93% success. Author (NSA)

N70-14792# Stanford Linear Accelerator Center, Calif.
SLAC SPIRAL READER PROJECT
M. Anderson, D. Budenaers, J. Caponera, R. Cochran, R. Good et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 468–476 Sponsored by AEC (See N70-14751 04-08)
Avail: CFSTI

The projection and film transport systems for the spiral reader are described. Diagrams are given for the electronic hardware used in the reader and the on-line control and calibration programs for the reader are discussed. R.B.

N70-14793# Joint Institute for Nuclear Research, Dubna (USSR).
FILM MEASURING SYSTEMS AT JINR, DUBNA
V. Shigaev *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. For Bubble and Spark Chambers Jan. 1969 p 477–480 refs (See N70-14751 04-08)
Avail: CFSTI

The film measuring system at JINR, Dubna is briefly discussed. The film data reduction and physics analysis have been accomplished by the two BESM-4 computers, a Minsk-22 computer and a CDC 1604A computer. In the future a BESM-6 computer will perform the same tasks. The scanning tables are briefly described with a brief note on on-line systems. Some details of the CRZ automatic measuring device for spark chamber films are included. NSA

N70-14794# Purdue Univ., Lafayette, Ind. Georgia Inst. of Tech., Atlanta.
POSSIBLE SOURCES OF LARGE ERROR IN DETERMINATIONS OF ION-MOLECULE REACTION RATES WITH DRIFT TUBE-MASS SPECTROMETERS
E. W. McDaniel Sep. 1969 21 p refs Prepared in cooperation with Georgia Inst. of Tech.
(Contract N00014-67-A-0226)
(AD-696075; TR-GIT-5-PU) Avail: CFSTI CSCL 14/2

Drift tube-mass spectrometers are now used extensively to measure the rate coefficients of ion-molecule reactions. The accuracy which can be obtained in favorable cases is about ten percent, but if careful attention is not paid to a number of factors, very large errors can result. The purpose of this paper is to call attention to this fact, which seems not to be widely known, and to enumerate the factors which can lead to these large errors.
Author (TAR)

N70-14829*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEOMAGNETIC SURVEY BY THE POLAR ORBITING GEOPHYSICAL OBSERVATORIES OGO-2 AND OGO-4, 1965–1967
Joseph C. Cain and Robert A. Langel Dec. 1968 31 p refs
(NASA-TM-X-63758; X-612-68-502) Avail: CFSTI CSCL 14B

The only complete pole-to-pole survey of the geomagnetic field to date is that performed by the polar Orbiting Geophysical Observatories OGO's 2, and 4. The magnetic survey instruments used on these spacecraft were optically pumped, self-oscillating rubidium vapor magnetometers measuring the absolute scalar field. The sampling interval was 0.5 seconds for OGO's 2 and 4. OGO 2 acquired data from launch until October 2, 1967 whenever the orbit was in full sunlight. OGO 4 operated almost continuously from launch until January 19, 1969. Author

N70-14846*# Harvard Coll. Observatory, Cambridge, Mass.
INSTRUMENTATION AND FLIGHT PERFORMANCE OF HCO HIGH RESOLUTION WAVELENGTH SPECTROMETER: NASA AEROBEE FLIGHT 4.185 US
W. H. Parkinson May 1969 39 p refs
(Contract NSR-22-007-067)
(NASA-CR-107441) Avail: CFSTI CSCL 14B

The performance of the HCO high Resolution wavelength spectrometer and the BBRC SPC 324 D/B solar pointing control on NASA Aerobee Flight 4.185 US is presented. Flight evaluation indicates the only system failure to have been in the pointing control. The reasons for this failure are discussed. It is possible to prevent future failures of this nature with improved reliability control. An outline of suggested new procedures is enclosed. Author

N70-14981# Atomic Energy of Canada, Ltd., Chalk River, (Ontario).
A VERSATILE RADIATION MONITOR USING A SILICON NUCLEAR PARTICLE DETECTOR
A. R. Jones Aug. 1969 30 p refs
(AECL-3455) Avail: CFSTI

A portable radiation monitor using a lithium drifted silicon detector has been developed for health physics. It can be used to: predict doses from gamma or X-rays, predict skin doses from beta rays, detect and estimate alpha, beta and gamma activity, distinguish between these forms, and detect fast neutrons while discriminating against gamma rays. The report describes the electronic and mechanical design of the instrument. The response of the monitor to ionizing radiations is also discussed and so are the effects of temperature and battery voltage on this response. A section on applications follow these. An appendix contains setting up procedures and instructions for connection to other instruments. Author

N70-15012# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEMICONDUCTOR THERMAL-JET ANEMOMETERS IN SYSTEMS FOR MEASURING NONELECTRIC QUANTITIES
V. A. Ferenets 25 Apr. 1969 21 p Transl. into ENGLISH from Russian conf.
(AD-694841; FTD-MT-24-520-68) Avail: CFSTI CSCL 14/2

Some pneumatic devices are discussed in which thermal-jet anemometers are used to convert negligible fluid flows into electric signals. Several types of differential thermal anemometers are considered by means of which it is possible to determine not only the rate of fluid flow but also its direction. Emphasis is placed on configurations with inner and outer fluid flow past heat-sensitive elements, and on single-chamber and double-chamber jet elements. It is noted that the sensitivity of semiconductor thermal-jet anomemeters is considerably higher than that of other devices. General design problems are considered for two instrument types with thermal-jet anemometers. Author (TAB)

N70-15033# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PRECISION LIQUID MANOMETER
S. I. Nepomnyashchiy 20 May 1969 8 p ref Transl. into ENGLISH from Nauchno.-Issled. Inst. Giorometeorol. Priborostr. Inform. Materialy po Gidrometeorol. Priboram i Metodam Nablyudeniy (Leningrad), no. 17, 1967 p 58–60
(AD-694153; FTD-HT-23-248-69) Avail: CFSTI CSCL 14/2

A high-accuracy liquid manometer was developed in which dibutylphthalate is used instead of mercury. The instrument is shown. It consists of a U-shaped tube, control scale, readout device, with magnifying glass. The right arm of the U-tube is evacuated to approximately 0.01 mm Hg. The vacuum is monitored by a thermocouple vacuum gauge. Since the density of dibutylphthalate is 13 times less than mercury, the accuracy of the read-out is approximately 10 times higher. The range of the instrument is 0-70 millibar. Author (TAB)

N70-15051# Perkin-Elmer Corp., Norwalk, Conn. Optical Group.
ULTRASONIC HOLOGRAPHIC IMAGING IN SOLIDS Final Report
Justin L. Kreuzer 30 Sep. 1969 42 p refs
(Contract DAAG46-67-C-0132(X))
(AD-695674; PE-ER-9754; AMMRC-CR-69-05(F)) Avail: CFSTI CSCL 14/5

The report describes a basic investigation of the ultrasonic holographic imaging of the interior of solids immersed in water. Ultrasonic holograms were recorded from coherently pulsed 5-megahertz ultrasonic radiation in a horizontal plane over the specimen by point-wise mapping in a TV-like raster with a

modified X-Y recorder. The ultrasonic holograms are recorded as a photographic transparency. When suitably illuminated, the hologram produces a visible three-dimensional image. Necessary modifications were made to the system previously built to permit the imaging of the interior of solids instead of only the exterior. Several holograms and satisfactory holographic images of 1-mm-diameter holes in aluminum specimens were made and are reproduced here. A hole in cast iron could not be holographically imaged because of ultrasonic scatter by the cast iron. Basic properties of these holographic images and the techniques used to produce them are described. Author (TAB)

N70-15169*# Bendix Corp., Davenport, Iowa. Instruments and Life Support Div.

POSITIVE GAGING SYSTEM FEASIBILITY STUDY Summary Report, 15 May – 15 Nov. 1967

T. A. Loftus 17 Apr. 1968 12 p

(Contract NAS9-6751)

(NASA-CR-102061) Avail: CFSTI CSCL 14B

The work was divided into two phases. During the first phase, a theoretical analysis was performed to detail the measurement of fuel dielectric properties, and define the performance of characteristics for several RF Fuel Mass Measurement Systems relative to a worst Apollo or LEM Spacecraft fuel and tank configuration. Experimental work was conducted on a limited basis to verify the theoretical predictions or to evaluate the measurement techniques. The experiments to determine system performance were performed using scale model SPS tanks, propellant simulants and laboratory type hardware. Predictions of full scale system performance were made by scaling to the actual tank and fuels for which the model was made. The performance of the system with other fuels in the particular tank configuration was included to enable a choice of a best gaging technique for a particular tank and fuel combination. During the second phase, an analysis was made of potential failure areas and their effect on the system performance. Conclusions were made on the performance of the systems investigated and recommendations for future evaluation or design and development were given. Author

N70-15178# National Research Council of Canada, Ottowa (Ontario). Translations Section.

MEASUREMENT OF THE MODULATION TRANSFER FUNCTION OF PHOTOGRAPHIC FILMS WITH THE AID OF AN INTERFERENCE APPARATUS [MESSUNG DER MODULATIONSUEBERTRAGUNGSFUNKTION PHOTOGRAPHISCHER SCHICHTEN MIT HILFE EINER INTERFERENZAPPARATUR]

H. Frieser et al 1969 14 p refs Transl. into ENGLISH from Phot. Korr. (Vienna), v. 102, no. 5, 1966 p 69–75

(NRC-TT-1387) Avail: CFSTI

The construction and calibration of an interference apparatus based on the Lloyd principle is described. It was constructed so as to generate sinusoidal intensity distributions of very different frequencies on the surface of the film, with which the modulation transfer function (MTF) of films can be determined. The effect of the microphotometer in the measurements of the film specimens, exposed in this apparatus, was investigated. The MTF of films of different sensitivity was measured together with its dependence on modulation and adjacency effect. Close agreement with a formulation made earlier of the blurring function was found. Author

N70-15211*# Bendix Corp., Davenport, Iowa. Instruments and Life Support Div.

POSITIVE GAGING SYSTEM FEASIBILITY STUDY Interim Report, 15 May – 15 Nov. 1967

T. A. Loftus 15 Feb. 1968 122 p refs

(Contract NAS9-6751)

(NASA-CR-102062; Rept-3914-1-68-1) Avail: CFSTI CSCL 14B

The work performed in a positive gaging system feasibility study is documented. Three RF techniques of mass gaging were studied, both theoretically and experimentally, to determine their capability to gage the propellants in Apollo or LEM spacecraft tanks. The theoretical work predicts the response of each technique relative to the propellants and tanks. A study was also made of the dielectric properties of the propellants over the expected range of operating conditions. Finally, a preliminary specification was made of the system's expected characteristics and components needed for the flight implementation of each of the techniques. Author

N70-15342# Washington Univ., Seattle. Dept. of Chemistry.

AN ANALOG COMPUTER CONTROLLED GAMMA-RAY SPECTROMETER FOR COMPARATIVE ACTIVATION ANALYSIS

P. C. Jurs and T. L. Isenhour *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 938–941 refs (See N70-15313 04-06)

Avail: SOD $8.50

An apparatus designed to perform real time comparative activation analysis is described. The instrument directly compares the gamma-ray spectrum from a standard and a mixed unknown to determine the weight of the desired species in the unknown sample. The instrument operates by subtracting a certain fraction of the sample activity from the unknown. If the correct fraction is subtracted, the spectrum of the mixture appears to contain no component from the sought species. In order to accomplish this, gamma rays are measured in two energy ranges, the first characteristic of the sought species, and the second characteristic of the interferences. If the correct fraction of the standard source is being subtracted from the mixture, the same effective half life is measured in each energy range of the unknown spectrum. Author

N70-15346# National Reactor Testing Station, Idaho Falls, Idaho.

GAMMA-RAY SPECTROMETRY AND AUTOMATED DATA SYSTEMS FOR ACTIVATION ANALYSIS

R. L. Heath *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 959–1031 refs (See N70-15313 04-06)

Avail: SOD $8.50

High resolution Ge(Li) spectrometers appear quite attractive for many applications in the field of activation analysis. The purpose of this review is to provide a capsule view of the state-of-the-art in high resolution photon spectrometry, to discuss in some detail the concepts of each element of a modern pulse height analysis system for general laboratory use in high resolution applications, and to present the role of digital computer based systems for data acquisition and on-line analysis. An introduction to the pertinent literature in this area is included, along with some background to supplement the papers illustrating applications of high resolution spectrometry. Author

N70-15347# Iowa State Univ. of Science and Technology, Ames. Dept. of Chemistry.

COMPARISON OF SOLID STATE AND SCINTILLATION GAMMA-RAY SPECTROMETRY IN ANALYSIS

Adolf F. Voigt, Duane E. Becknell, and Sr. Laurene Menapace *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1035–1042 refs Sponsored by AEC *Its* Contrib. No. 2424 (See N70-15313 04-06)

Avail: SOD $8.50

Solid state Ge(Li) detectors and NaI(Tl) scintillation detectors were compared in terms of their relative precision in determining elements in non-stoichiometric potassium-tungsten and

lanthanum-tungsten bronzes and analyzing rare earth mixtures. Results show that the scintillation detector generally was more efficient, while the solid state detector yielded higher resolutions.
E.C.

N70-15348# Air Force Systems Command, Wright-Patterson AFB, Ohio. Flight Dynamics Lab.
MEASUREMENT AND COMPARISON OF DETECTOR EFFICIENCIES
John A. Dooley *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1043–1048 refs (See N70-15349 04-06)
Avail: SOD $8.50

Usage of the inverse-square law allows for direct, accurate, and relatable detector efficiency determinations. The method involves measurement of a standard source at two or more distances from the detector. A plot is made of the inverse square root of the count area as a function of source-detector distance. From this plot can be derived two quantities which give important information about the detector: (1) the slope, in conjunction with the source emission rate, gives an efficiency factor which is independent of measurement distances, of placement of the detector within the can and, to some extent, is independent of detector shape, (2) the distance intercept gives the distance of closest approach of a source to the effective center of detection, and consequently the maximum detector efficiency can be computed. Together, the two quantities allow computation of efficiency for any source-detector distance, including the maximum efficiency attainable by the detector.
Author

N70-15349# Shell Development Co., Emeryville, Calif.
INSTRUMENTATION FOR COMPUTERIZED NEUTRON ACTIVATION ANALYSIS
D. D. Tunnicliff, R. C. Bowers, and G. E. A. Wyld *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1049–1053 ref (See N70-15313 04-06)
Avail: SOD $8.50

The efficient application of least squares computer calculations to neutron activation analysis involves different requirements on the instrumentation. It is desirable to develop the instrumentation and the computer programs as parts of a complete system of analysis if optimum performance is to be achieved. This paper is concerned only with the instrumentation. Some of these special requirements and solutions for them are described.
Author

N70-15350# Battelle-Northwest, Richland, Wash. Environmental and Life Science Div.
AN ANTICOINCIDENCE SHIELDED Ge(Li) GAMMA-RAY SPECTROMETER AND ITS APPLICATION TO NEUTRON ACTIVATION ANALYSIS
J. A. Cooper, L. A. Rancitelli, R. W. Perkins, W. A. Haller, and A. L. Jackson *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1054–1061 refs (See N70-15313 04-06)
(Contract AT(45-1)-1830)
Avail: SOD $8.50

An anticoincidence shielded Ge(Li) gamma-ray spectrometer, which was designed to provide a high degree of Compton reduction along with high efficiency and resolution, is described and its use in extending the applications of nondestructive activation analysis is illustrated.
Author

N70-15351# Cornell Univ., Ithaca, N.Y.
A COINCIDENCE-ANTICOINCIDENCE SYSTEM FOR ACTIVATION ANALYSIS EMPLOYING A SPLIT NaI(Tl) ANNULUS AND A LARGE VOLUME Ge(Li) DETECTOR
R. L. Currie, R. McPherson, and G. H. Morrison *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1062–1068 refs Sponsored in part by AEC (See N70-15313 04-06)
Avail: SOD $8.50

A large Ge(Li) detector with very good resolution and high peak-to-Compton ratio was inserted midway into the 3 in. diameter tunnel of an 8 in. diameter by 10 in. long NaI(Tl) annulus, and experiments were done with the source on the cryostat window for maximum sensitivity. This geometry also permits the use of the annulus in NaI(Tl)-Ge(Li) coincidence experiments on the source itself. A system was devised to permit several simultaneous experiments to be performed using the detector combination with a single multichannel analyzer.
Author

N70-15352# Shell Development Co., Emeryville, Calif.
A DUAL CHANNEL ANALYZER AND EFFICIENT COINCIDENCE SYSTEMS FOR ACTIVATION ANALYSIS
Ralph A. Johnson *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1069–1074 refs (See N70-15313 04-06)
Avail: SOD $8.50

The present study is oriented around systems involving single channel analyzers, coincidence gates, and scalers with readout suitable for data handling by computer. It is concerned with multichannel analyzers only for qualitative spectrum observation and as an aid in setting the single channel analyzers. Modifications of a single channel analyzer are described which convert it into a dual channel analyzer. An analysis is given of the different kinds of coincidences encountered with two-photon cascade systems and their relationship to instrumental arrangements, selectivity, and counting efficiencies.
Author

N70-15353# Los Alamos Scientific Lab., N. Mex.
CHARACTERISTICS AND APPLICATIONS OF A LARGE SODIUM IODIDE DETECTOR ASSEMBLY
Jack L. Parker, Dale M. Holm, and Barry K. Barnes *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1075–1080 Sponsored by AEC (See N70-15313 04-06)
Avail: SOD $8.50

Response functions have been measured for a large sodium iodide double-crystal detector assembly. The assembly, used by itself and in conjunction with lithium-drifted germanium detectors, has been studied for applications in activation analysis and gamma-ray spectroscopy.
Author

N70-15354# Naval Radiological Defense Lab., San Francisco, Calif.
A COMPTON-SUPPRESSED COINCIDENCE GAMMA-RAY SCINTILLATION SPECTROMETER WITH LARGE NaI(Tl) CRYSTALS
B. A. Euler, D. F. Covell, and S. Yamamoto *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1081–1087 refs (See N70-15313 04-06)
Avail: SOD $8.50

A Compton-suppressed coincidence gamma-ray scintillation spectrometer has been assembled to obtain high sensitivity and selectivity in gamma-ray spectral measurements. The spectrometer is intended to satisfy requirements for the identification and estimation of low levels of gamma-ray radioactivity in a broad range of sample sizes and masses containing moderately complex mixtures of gamma-emitting radionuclides. The energy range of interest is 0–3 MeV. This spectrometer is similar in concept to an earlier design but changes have been incorporated to: (1) eliminate deficiencies, (2) satisfy requirements of the intended application, and (3) take advantage of improvements in the design and production of commercially available components.
Author

N70-15428# Rome Air Development Center, Griffiss AFB, N.Y.
PHOTO-RECORDING PRESENT AND FUTURE
David E. Wilcox and Leon McDowell *In* AGARD Displays for Command and Control Centers Jul. 1969 p 273–293 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI

Film display techniques have been very prominent in the field of display technology. Most of the present large screen display devices in operational service are based on the application of silver halide film. This chapter applies specifically to computer generated displays, and discusses the design of several equipments in Command and Control Systems. The problems that have become apparent with the silver halide technique are pointed out in discussing general design considerations of presently existing equipment. The technique has satisfied many of the past requirements and will continue to be employed in future equipment. However, the logistic and maintenance support required for these equipments has prompted a considerable amount of technique development and application during recent years and further work is still required before any one of the techniques is acceptable for operational implementation. This chapter discusses various techniques that show considerable promise, and points out where the state of development is at this time. Author

N70-15493*# Catholic Univ. of America, Washington, D.C.
COMPLETION OF DESIGN AND FABRICATION OF A ROCKET PAYLOAD FOR SEARCH OF THE SOUTHERN HEMISPHERE SKY FOR GALACTIC X-RAY SOURCES Final Report
C. Stuart Bowyer and Michael Lampton [1969] 30 p refs Prepared jointly with California Univ.
(Contracts NSR-09-005-056; NSR-05-003-287)
(NASA-CR-107559) Avail: CFSTI CSCL 14B

Areas of instrumentation developed are: Aerobee payload, galactic X-ray astronomy from a balloon and a far ultraviolet photometer. The galactic X-ray instrument consists of a stabilized balloon gondola with a polar axis telescope mount. The far ultraviolet photometer was used for searching out radiation in the earth's geocorona and from objects in the night sky. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-14117# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE PROPERTIES OF LOW-NICKEL AND NICKEL-FREE CASEHARDENING STEEL GRADES WITH A VIEW TO USE IN HEAVY-DUTY GEARS
V. P. Antropov, Yu. P. Oschepkov, and L. L. Dyatakova 3 Feb. 1969 14 p refs Transl. into ENGLISH from Izves. Vysshikh Uchebnykh Zavedenii. Mashinostroenie, (Russian), no. 7, 1966 p 119–125
(AD-695196; FTD-HT-23-874-68) Avail: CFSTI CSCL 13/9

Properties of low-nickel and non-nickel carburized grades of steel applicable for heavy-loaded gear wheels are discussed in extensive laboratory and industrial experiments to study the physicomechanical properties of samples of Cr-Ni low-Ni, and non-Ni Si-Mn steels and to investigate the strength properties of gear wheels. Author (TAB)

N70-14143# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL ANALYSIS OF SAMPLING ACCURACY OF THE ROLLING BODY OF THE BEARING
Wen Chang-Sen 17 Apr. 1969 12 p refs Transl. into ENGLISH from Chiliag Chishu Yu, Chi Chih Tsao, (Mainland), v. 4, no. 3, 1966 p 161–165
(AD-695210; FTD-HT-23-140-69) Avail: CFSTI CSCL 13/9

This paper maintains that the diametric correlative measurement deviation of the rolling body (roller, ball, or rolling pin) of a rolling bearing is an important index of the precision of the finished bearing. Solutions are presented to three problems in an attempt to establish the statistical correlation between the maximum deviation of sub-samples and the deviation of the parent body (the entire rolling body). TAB

N70-14171+ Laboratorio de Acustica e Sonica, San Paulo (Brazil).
ULTRASONIC INSPECTION FOR EVALUATION OF THE BOND BETWEEN THE BABBIT AND BASE METAL
H. Onusic and M. F. Barbosa 9 Jun. 1969 12 p In PORTUGUESE
Avail: CFSTI

The study describes the procedure, equipment, and accessories used in the ultrasonic inspection of a series of large metallic bearings in order to evaluate the bonding between the babbit and the base metal. The results are presented in graphic form, including photos of the observed echograms. Author

N70-14183# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF TIES ON THE VIBRATION ENDURANCE OF TURBINE BLADES
D. A. Arkadev 27 Mar. 1969 14 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 14, no. 3, 1968 p 6–9
(AD-695201; FTD-HT-23-1254-68) Avail: CFSTI CSCL 13/7

The purpose of the study was to determine and compare the vibrational characteristics of blades with soldered and nonsoldered damping lacing. The tests were made with: (1) a set of ten blades with a lacing wire soldered to them, which were compared with results obtained in tests using blades with unsoldered lacing wire; (2) a similar set, which consisted of seven blades, used to determine the effect of the number of blades on the dynamic stresses and to compare stresses in the center and at the end of the blade set; (3) a set of ten blades with an unsoldered lacing wire tested to compare vibration characteristics with other sets using soldered lacing wires. After static and dynamic testing of the first set and dynamic testing of the second set, the soldered lacing wire was cut and the remaining set of seven blades was tested. The test results indicate that soldering of lacing wire to a set of blades significantly reduces the vibration amplitude of the first harmonic oscillations. Author (TAB)

N70-14230# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENT ON THE CONDITIONS OF CONCEPTION OF ZONES OF ROTATING STALL
N. V. Belan 2 Apr. 1969 12 p refs Transl. into ENGLISH from Samoletostroenie i Tekhnika Vozdushnogo Flota, (Russian), no. 5, 1966 p 73–76
(AD-695205; FTD-MT-24-494-68) Avail: CFSTI CSCL 13/7

The author experimented on a series of insulated running wheels and stages with stationary equipment in order (1) to find a more precise definition of the conditions of conception of rotating stall zones (2) to find which values of leakage angles occur in these zones and (3) to determine the effect of geometric characteristics of a blade row stage of an axial-flow compressor at these angles. The author reports that blade clearance has a strong effect on the flow pattern during rotating stall. Forty-four variations of stages (26 stages with entry guiding devices, 14 with outlet rectifying devices,

4 three-section stages) were investigated. The obtained results make it possible to affirm that with sufficient accumulated data on the value of leakage angles corresponding to the conception of rotating stall zones, reliable experimental criteria on the limitation of the working ranges of a stage without rotating stall may be established. TAB

N70-14240# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AIRCRAFT WITHOUT RIVETS
20 Feb. 1969 8 p Transl. into ENGLISH from Hang K'ung Chih Shih, (Mainland), v. 3, 1960 p 30
(AD-694824; FTD-HT-23-677-68) Avail: CFSTI CSCL 13/8

At present, in constructing supersonic aircraft, a new method of joining metal parts has been extensively used - welding and high-strength cementing. Under these circumstances, the skin is fastened to a special metallic honeycomb. The honeycomb structural material is made into the same airframe for the outer profile and airfoil and joined together by many metal stiffeners. From this airframe are formed the wing, tail and fuselage. The use of the honeycomb structure can reduce the aircrafts weight and increase its strength by 15-30%. Cementing (with a plating action) can also increase the components ability to resist corrosion. Further, labor can be saved in aircraft construction. Author (TAB)

N70-14244# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DETERMINATION OF THE BASIC PARAMETERS OF BLADED CHAMBER PUMPS AND HYDRAULIC MOTORS
M. M. Valdaev 15 Apr. 1969 9 p refs Transl. into ENGLISH from Tr. Sentr. Nauchn.-Issled. Inst. Morsk. Flota (Leningrad), no. 86, 1967 p 37-40
(AD-694835; FTD-HT-23-1317-68) Avail: CFSTI CSCL 13/7

In systems of industrial hydraulic drive a wide application has been obtained by bladed (slide valves) high-speed pumps and hydraulic motors. In foreign vessels and in the Soviet river fleet bladed high-torque low-speed hydraulic motors and pumps have become most widely distributed. The peculiarities of the design and method of regulating the bladed chamber pumps and hydraulic motors are examined in the articles. Author (TAB)

N70-14286# Air Force Systems Command, Wright-Patterson AFB, Ohio.
AN INVESTIGATION OF THE CHANGE IN THE ELECTRICAL AND MECHANICAL PROPERTIES OF A BIMETAL COPPER NICKEL WIRE IN THE PROCESS OF ITS MANUFACTURE AND PROLONGED HEAT TREATMENT
E. S. Shpichinetskii and Yu. A. Emelyanov 24 Apr. 1969 15 p refs Transl. into ENGLISH from Gosudarstvennyi Nauchno Issledovatelskii i Proektnyi Inst. Splavov i Obrabotki Tsvetnykh Metallov (Moscow), no. 26, 1967 p 149-156
(AD-694821; FTD-MT-24-79-69) Avail: CFSTI CSCL 9/1

Bimetal copper-nickel wire is used in current-conducting cores of magnet wire operating at temperatures of up to 500 degrees C. The fabrication of this wire is based on drawing of bimetal billets represented by nickel-sheathed copper rods; the drawing is alternated with multistage intermediate annealing at 650-800 degrees C. Hence, the investigation is concerned with the variations in the electrical and mechanical properties of the bimetal wire during its fabrication under these conditions, with the object of determining the stability of these properties in magnet wire under normal operating conditions. It is established that high annealing temperatures affect more markedly the electrical properties of bimetal wire by promoting interdiffusion between Ni and Cu; hence, these temperatures must be limited to a minimum. A similar effect is produced by the degree of deformation and time of annealing. TAB

N70-14297# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
FABRICATION OF EXPERIMENTAL TUBING
J. S. Nelles *In its* Mater. Res. at Chalk River Oct. 1969 p 11-13 (See N70-14293 04-17)
Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

Planetary rolling is used to produce zirconium alloy tubing by reduction of extruded shells. The tube shells are hot extruded from 38.0 mm diameter billets at an extrusion ratio of 16.5:1. The billets are copper clad since zirconium galls and sticks to the die steel at the elevated temperatures. The copper cladding is removed from the extruded tube shell by pickling. The tube shells are cold reduced from 1.35 mm wall to 0.4 mm wall by planetary rolling in seven passes, with one initial and two intermediate anneals. Planetary rolling reduces the wall thickness by rolling steel balls circumferentially around the outer diameter of the tube while compressing the tube wall against a mandrel. R.B.

N70-14325# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIOACTIVE ISOTOPES IN THE STUDY OF WEAR AND AUTOMATION OF WEAR CONTROL
V. I. Postnikov 24 Apr. 1969 151 p refs Transl. into ENGLISH of the book 'Radioaktivnye Izotopy v Issledovanii i Avtomatizatsii Kontrolya Iznosa' Moscow, Mashinostr., 1967 p 1-140
(AD-695926; FTD-HT-23-1466-68) Avail: CFSTI CSCL 13/9

This book presents a radioactive-isotope method for continuous or periodic control of wear resistance of machine parts and mechanisms with emphasis on its application in controlling wear of cylinder bushings in internal combustion engines. This method is suitable for wear control during engine bench testing, and requires isotopes with low radioactivity only, thus eliminating any need for special equipment. The book is intended for engineers working on problems of machine wear and its reduction and, it may also be used by students of machine engineering at the institutions of higher education as well as in technical schools. Author (TAB)

N70-14362# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DRAWING UNDER LIQUID FRICTION CONDITIONS
V. L. Kolmogorov et al 15 Jul. 1969 100 p refs Transl. into ENGLISH from Volechenie v Rezhime Zhidkostnogo Treniya (Moscow), 1967 p 1-155
(AD-695903; FTD-MT-24-483-68) Avail: CFSTI CSCL 13/9

The book discusses the contemporary state of the problem and the accumulated experience on the introduction of technology of wire and tube drawing under liquid friction conditions. There are given fundamentals of theory and method of calculation of adapter for drawing dies. TAB

N70-14364# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW VACUUM EQUIPMENT FOR DEPOSITING THIN FILMS
E. V. Churkin et al 21 May 1969 29 p refs Transl. into ENGLISH from Tr. Inst. Komiteta (USSR), no. 90, 1967 p 112-120
(AD-695888; FTD-MT-24-23-69) Avail: CFSTI CSCL 13/8

A new device for depositing thin metal films in a vacuum is presented, and its application for depositing thin film electrodes on quartz resonators is discussed in detail. The apparatus permits elements to be coated and sealed without exposing them to the atmosphere and makes possible electrodes of any configuration. It can also be used to adjust oscillation frequency to nominal. Author (TAB)

N70-14387# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF

THE RELATIVE GAP OF A SLIDING BEARING ON ITS CARRYING CAPACITY

V. A. Slobodkin 20 Jun. 1969 8 p Transl. into ENGLISH from Novocherk. Politekhnicheskii Inst. Trudy (USSR), v. 160, 1966 p 39–42

(AD-695939; FTD-MT-24-09-69) Avail: CFSTI CSCL 13/9

In order to evaluate the influence of the geometric parameters of a bearing on its carrying capacity and the onset of liquid friction, the author conducted experimental investigations of sliding bearings. The investigations were performed using the theory of physical similitude, and the results were processed in a critical form in order to be able to extend the final evaluation relationships to other bearings, similar to those investigated. It is found that the magnitude of the relative gap influences the onset of liquid friction in a bearing and the carrying capacity of the bearing. The bearing load coefficient at the instant of separation of friction surfaces rises with an increase in the relative gap. TAB

N70-14403# Technische Hogeschool, Eindhoven (Netherlands).

THEORIES AND MEASUREMENTS IN CHARACTERISTIC PROBLEMS OF HYDROSTATIC VANE PUMPS [THEORIEN UND. MESSUNGEN ZU CHARAKTERISTISCHEN PROBLEMEN DER HYDROSTATISCHEN FLUEGEL-PUMPEN]

Peter Wuesthof (Ph.D. Thesis - Tech. Hogeschool, Eindhoven) 18 Nov. 1969 132 p refs In GERMAN

Avail: CFSTI

Although hydraulic vane pumps do not reach comparable pressures and efficiency degrees as piston pumps, their simple construction allows for direct transfer of mechanical energy into hydraulic energy. The development of vane pump families from otherwise unchanged basic units through change of displacement capacity is only possible to a limited degree. Axle inclination difference cannot be extended unlimited in relationship to blade dimension. Only one third of the blade surface is utilized for pressure production during displacement motion whereas two thirds of the vane remain in the rotor slit. Vane pumps that exceed the correlation of lift height and blade dimension by a factor of 8 are not practical. Transl. by G.G.

N70-14413# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

USE OF MOLYBDENUM DISULFIDE IN THE MANUFACUTRE OF CABLES

S. F. Chukmasov et al 30 Jan. 1969 8 p refs Transl. into ENGLISH from Vsesoyuznyi Simpozium po Probl. Prochnosit i Dolgovechnosti Stalnykh Kanatov 4th, 1966, Mat. (Moscow), 1967 p 188–192

(AD-694786; FTD-HT-23-667-68) Avail: CFSTI CSCL 13/9

The use of molybdenum disulfide as a wire drawing lubricant was experimentally investigated. The molybdenum disulfide used in the study was a synthetic grade, having a particle size of 60 microns. One batch of this material was ground ultrasonically to a particle size of 10-15 microns, and another was ground in a super-vibromill to a particle size of 3-8 microns. Six types of cables were made from wire, and testing was done to determine the friction force between the cable elements. The friction force for two types of cables made from wires drawn with molybdenum disulfide lubricant was compared to that for ordinary cables. Testing was done on a machine which simulated service conditions. TAB

N70-14418# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF THE EFFECT OF MICROSCOPIC SURFACE IRREGULARITIES ON THE FORCES OF FRICTION

A. N. Kravtsov 25 Apr. 1969 14 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Priborostr. (Leningrad), v. 11, no. 1, 1968 p 121–127

(AD-695357; FTD-MT-24-473-68) Avail: CFSTI CSCL 13/8

The article examines questions of the formation of surface microreliefs finished by a new pressure method - vibration spinning - and the results of an experimental study of the effect of surface microrelief on frictional forces. Author (TAB)

N70-14419# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

FLUIDISTOR FABRICATION IN SMALL SERIES

Goran Lundstrom 1969 43 p refs

(AF-703-1) Avail: CFSTI

Methods suitable for both laboratory and industrial fabrication of fluidistors are surveyed. Of these it was found that for fluidistor circuits with small nozzle widths the chemical milling and epoxy moulding methods were the most suitable for an in-house laboratory fabrication. The epoxy moulding process based on Dycril plates, silicon rubber and IR-epoxy will now result in glass clear fluidistor components and integrated circuits with smallest recommended nozzle width 0.5 mm. Epoxy moulding on a ferrite table is so far recommended only for large fluidistors, when high accuracy or parameter changes are required. The chemical milling process has many advantages: possibility of small nozzle widths; almost unlimited design flexibility; machinability of almost any metal; low investment cost of machining, setup, and tooling; short time between idea and ready-made fluidistor; and unchanged physical properties of milled metal. Author

N70-14448# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FEATURES OF PRODUCTION OF DISC FORGINGS FROM STEEL 1Kh 12 VNMF (EI802)

I. G. Generson et al 12 Dec. 1968 13 p Transl. into ENGLISH from Energomashinostroenie (Moscow), v. 13, no. 7, 1967 p 31–34

(AD-694384; FTD-HT-23-1016-68) Avail: CFSTI CSCL 21/5

An experimental study of the production of two different types of turbine forgings of this steel both lacking any central apertures, indicates that despite their metalurgical complexity, they can in principle be satisfactorily processed if they are first cast in a basic furnace with blowing of oxygen through the molten bath and if their hot forging includes prior deep drawing with a reduction ratio of at least 2-2.5 and intermediate up-setting and is followed by isothermal annealing at 710-720C along with two-stage supercooling. Deep drawing and intermediate upsetting together serve to weld up the shrinkage defects, while supercooling assures a virtually total transformation of austenite and hence also the absence of any major phase stresses due to the decomposition of residual austenite in the cooled forging, and the prolonged isothermal annealing contributes to the diffusion of hydrogen, thus preventing flake formation and hydrogen embrittlement of the metal. Author (TAB)

N70-14458# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AIRCRAFT SHOCK ABSORBER-LANDING GEAR RETRACTOR

Ya. A. Kogan et al 8 Apr. 1969 6 p Transl. into ENGLISH from Russian Patent no. 199678 (12 Mar. 1966) p 1–2

(AD-695321; FTD-HT-23-1365-68) Avail: CFSTI CSCL 13/9

An Author Certificate has been issued for a combination shock-absorber and retracting gear for aircraft wheels, which consists of a cylinder with attachment brackets and unions for filling and emptying the working fluid, a piston and a rod with diffusers, a lock, and a floating piston which moves inside the cylinder. To increase operating reliability, and decrease weight and size, it contains a cup attached concentrically to the rod by an annular piston support; between the rod and cup is mounted a spring which interacts on one end with the rod and on the other end through the floating piston with the lock, which is located in the upper part of the cylinder. Author (TAB)

N70-14480*# Oak Ridge National Lab., Tenn. Reactor Div.
SURVEY OF INFORMATION ON TURBINE BUCKET EROSION
A. P. Fraas, H. C. Young, and A. G. Grindell Jul. 1968 109 p refs
(NASA Order W-12353; Contract W-7405-eng-26)
(NASA-CR-107429; ORNL-TM-2088) Avail: CFSTI CSCL 13I

Experience with erosion in steam, mercury, and potassium vapor turbines has been reviewed both by examination of the literature and by discussions with personnel concerned with turbine bucket erosion problems. Analytical and experimental investigations of turbine bucket erosion and related processes such as cavitation erosion and damage to targets in ballistics tests are reported. Particular attention is given to a comparison of the erosion experience in steam, potassium, and cesium turbines. The results of the work are summarized in a series of curves and tables. The information assembled has been used as the basis for a set of recommended criteria for vapor turbine designs to be used in a design study comparing the relative merits of cesium and potassium vapor cycles for space power plants. Author

N70-14489# Watervliet Arsenal, N.Y. Benet R&E Labs.
ANALYSIS OF STRIP EXTRUSION THROUGH CURVED AND SQUARE DIES
Peter T. C. Chen Sep. 1969 43 p refs
(AD-695655; WVT-6928) Avail: CFSTI CSCL 13/8

A method for selecting admissible velocity fields is presented for incompressible material. As illustrations, extrusion processes through three basic types of curved dies have been treated: cosine, elliptic and hyperbolic. Upper-bound theorem is used in obtaining mean extrusion pressures and also in choosing the most suitable deformation pattern for extrusion through square dies. Effects of die geometry, friction, and material properties are discussed. Author (TAB)

N70-14517# Parsons and Whittemore, Inc., New York
A BLEACHED STRAW PULP MILL FOR AN AGRO-INDUSTRIAL COMPLEX
J. N. Mc Govern *In* AEC Abundant Nucl. Energy May 1969 p 205-218 refs (See N70-14504 04-15)
Avail: CFSTI

The size and type of a hypothetical pulp mill to be part of an agro-industrial complex and to use residual wheat straw are developed; the choice of a pulping process is discussed; process and material flows for the resultant 500 ton/day bleached sulfate pulp mill are shown. The mill would use power, heat, and water from the complex. The properties of short-fiber straw are compared with those of wood fibers, and a promising market for the straw pulp in the manufacture of book paper in developing countries is indicated. Plant-site factors are mentioned briefly. Capital requirements for the hypothetical mill are estimated at $60 to $65 million. It is considered that the hypothetical mill could be practical. Author (NSA)

N70-14598# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROTECTIVE PROPERTIES OF ANTIFRICTION COATINGS DEPENDING ON THE TYPE OF OIL
S. P. Artemev 23 Jun. 1969 7 p Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no. 3, 1968 p 70-73
(AD-695906; FTD-MT-24-123-69) Avail: CFSTI CSCL 13/6

The article reports the results of work, carried out for the purpose of determining the most effective method of antifriction treatment of surfaces of teeth in hypoid transmission, for increasing of wear resistance and antiburr ability. The object of investigation was the hypoid transmission from an automobile which is the most common among Soviet passenger motor vehicles. Author (TAB)

N70-14600# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL DEVICE FOR THE INVESTIGATION OF SLIDING FRICTION
S. S. Alekseev et al. 13 May 1969 12 p refs Transl. into ENGLISH from Politekhnicheskii Inst. Tr., (Leningrad), no. 284, 1967 p 87-91
(AD-695308; FTD-MT-24-459-68) Avail: CFSTI CSCL 20/11

Two machines were constructed for studying sliding friction at low and high velocities. One of the machines was used for studying friction for sliding velocities ranging from 0.005 to 0.35 mm/min, and the second for studying sliding velocities from 2 to 2800 mm/min. The hydraulic and mechanical components of the equipment are shown in schematic diagrams. The machine for studying friction at low slip velocities consisted of a slide bar positioned between two loading members for applying normal loads to the bar. Motion was imparted to the slide bar by a piston operating under oil pressure. The specific pressure acting normal to the slide bar could be regulated. Friction forces were recorded as a function of time by means of a strain gage (glued to the upper plate) and an oscillograph. For changes in slip velocity from 0.005 to 0.35 mm/min the friction force remained constant, other things being equal, and sometimes even increased somewhat. A sharp increase or decrease in friction force during the motion of the slide bar did not occur for all ranges of velocity, with or without lubricant. The differences between static and dynamic friction were negligible. The apparatus for studying friction at slip velocities up to 2800 mm/min is also described. Strain gages were used to measure the friction force. Studies were conducted on cast iron-cast iron, steel-cast iron, steel-steel, and other types of surfaces. Author (TAB)

N70-14612# National Engineering Lab., Glasgow (Scotland). Materials Group.
THE EFFECT ON THE EXTRUSION OF STEEL OF A PRIOR EXTRUSION OPERATION
A. K. Cruden Jan. 1968 36 p refs
(NEL-341) Copyright. Avail: CFSTI

A study has been made of the effect on the extrusion of a component of a prior extrusion operation. The need to anneal the work material between operations has been assessed. It has been established that interstage annealing can be avoided by a careful choice of the conditions under which the two extrusion operations are performed. A high extrusion ratio ($R > 2$) and/or a conical-entry die of small included angle (theta < 45 deg) in the second extrusion operation is necessary if fracture of the component is to be avoided. In the extrusion of tube from a backward extruded can in mild steel En2E the time of transfer between the two operations has a significant effect on the condition of the tube. Author

N70-14637# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GRINDING AT THE PRESENT-DAY STAGE
G. B. Lure 5 Aug. 1969 13 p Transl. into ENGLISH from Mashinostroitel (USSR), no. 11, 1967 p 28-31
(AD-696050; FTD-MT-24-140-69) Avail: CFSTI CSCL 13/8

The history of the development of abrasive tools and materials is outlined briefly, and recent advances in Soviet grinding are described. Materials such as synthetic corundum, silicon carbide, and cubic boron nitride are mentioned. Critical loads as a function of the grain size of the abrasive is analyzed. Precision grinding, high-speed grinding, electrolytic polishing, methods of increasing productivity, reduction of maintenance time, automation of the operating cycle, and automatic lines with built-in grinding machines are treated briefly. Author (TAB)

N70-14645# Battelle Memorial Inst., Columbus, Ohio.
CALCULATION OF GEOMETRICAL PARAMETERS IN

DESIGNING THE FORGING PROCESS FOR AXISYMMETRIC SHAPES Interim Topical Report No. 5

T. Altan, D. E. Nichols, H. J. Henning, and A. M. Sabroff 15 Oct. 1969 51 p refs
(Contract DAAG46-68-C-0111)
(AD-695686) Avail: CFSTI CSCL 13/8

A computer program in FORTRAN language was developed for calculating geometrical parameters for axisymmetric forgings. Using the dimensions and the angles given in the engineering drawing of the forging, the program calculates the forging volume and weight. The shape-difficulty factor may prove useful in process design, for cost estimating, and for assisting engineers to make decisions about feasibility and difficulty in manufacturing. Empirical equations suggested by German and Soviet workers are used for calculating the flash dimensions and the flash weight. The computer program is applied to various forgings, and theoretical results are found to agree with actual experimental data. The developed computer program is now available to interested forging companies. It could be used for a systematic analysis of existing forging data, for making cost estimates after incorporating in-house cost factors, or for designing axisymmetric forgings with minimum additional effort. Author (TAB)

N70-14651*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE PROCESSING AND MANUFACTURING MEETING
21 Oct. 1969 546 p refs Presented at the Space Process. and Manufacturing Meeting, MSFC, Huntsville, Ala., 21-22 Oct. 1969
(NASA-TM-X-62560; ME-69-1) Avail: CFSTI CSCL 13H

Research and development work on materials manufacturing and production engineering in space is reported. Emphasis is placed on effects of reduced gravity on crystal growth and metal working processes. For individual studies see N70-14651 through N70-14682.

N70-14652*# National Aeronautics and Space Administration, Washington, D.C.
EARTH ORBITAL PAYLOAD PLANNING
William O. Armstrong *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 10-40 (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

Processing and manufacture of materials in orbit is shown as one of the more promising elements of future earth orbital payloads. Plans for including it in the experiments program of the next decade are outlined and compared with preliminary planning for flight programs in this period. Space vehicles such as the AAP Workshops, the Space Station and the Shuttle are described and related to program planning for processing and manufacture of materials in orbit. Some of the major milestones in the evolution of such a program are also described. Author

N70-14653*# American Optical Co., Southbridge, Mass.
GLASS PREPARATION IN SPACE
Emil W. Deeg *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 41-58 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

Low gravity, ease of access to high energy radiation and to high vacuum are conditions making an earth orbiting laboratory unique for developing new glass making processes. Among them are crucible free melting, preparation of glasses sensitive to thermal convection, formation of lenses and mirror blanks with fire polished surface directly from the melt, formation of dispersion filters, ruby glasses and glass-ceramics requiring nucleation control through solid powder dispersion. Advantages of these methods and difficulties to be expected in performing the first experiments will be discussed. Author

N70-14654*# General Electric Co., Philadelphia, Pa.
SPACE PROCESSING OF ELECTRONIC CRYSTALS
E. C. Henry and L. R. Mc Creight *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 79-114 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

A method for growing various high temperature oxidic crystals is described. The crystals are precipitated and grown from a glass solvent in which the desired crystal constituents have been previously dissolved. It is proposed to conduct a space experiment on this process of growing crystals as a means of overcoming the gavitational effects, and to obtain crystals with fewer vacancies and dislocations as a consequence of the near absence of convection that zero-g should provide. The recommended choice for a space experiment is potassium sodium niobate. Author

N70-14655*# Grumman Aerospace Corp., Bethpage, N.Y.
BORON FILAMENT MANUFACTURE IN SPACE: A LITERATURE FEASIBILITY STUDY
David Kloepper and Robert Witt *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 79-114 (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

This paper presents a comprehensive review of technical literature pertaining to the manufacture of boron filament on Earth. A possible space manufacturing process for boron filament is described. Several central substrate deposition techniques, using different core materials, electric decomposition, and other boron-containing raw materials, are discussed. Nonsubstrate deposition techniques, such as glow discharge on a rotating disc or between two pointed tungsten electrodes, are described. Several techniques to manufacture boron filament from the melt are discussed. This survey points out a way to manufacture boron filament in space that involves heating high-purity boron to 2800 F in boron nitride crucibles, and then transferring it into an RF-positioning field for further heating by induction coils or hot gas. Author

N70-14656*# General Electric Co., Philadelphia, Pa.
WEIGHTLESS, CONTAINERLESS MELTING AND SOLIDIFICATION OF POTENTIAL NEW METAL AND CERAMIC PRODUCTS
R. T. Frost *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 115-134 (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

A number of suggestions have been made for the weightless processing in space of metals and ceramics. The most obvious application of a weightless environment is the removal of buoyancy forces in multi-phase systems and the possibility for containerless melting and solidification processes. Under the first category, processes which can be considered are the casting of superalloy materials containing rare earth oxide inclusions and the casting of metal emulsions where convection currently leads to phase segregation. Under containerless processing we can consider extensions and scale up of processes which have been studied in terrestrial levitation experiments. Possible applications are the preparation of ultrapure materials and solidification under conditions of extreme subcooling. Author

N70-14658*# North American Rockwell Corp., Downey, Calif.
POSSIBILITIES FOR PRODUCING NEW GLASSES IN SPACE
R. A. Happe *In* NASA. Marshall Space Flight Center Space Process and Manuf. Meeting 21 Oct. 1969 p 146-175 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

Zero gravity melting permits the elimination of a solid container

during both the melting and cooling phases of glass production. The combination of superheating well above the melting temperature and cooling in the absence of most normal nucleation sites promises to permit the production of glasses from normally crystalline materials such as Al2O3, HfO2, ZrO2, etc. Such glasses should find immediate applications in refractive optics, where the unusual combinations of index of refraction and dispersion can be used to advantage in highly corrected multi-element lenses. The possibilities for returning supercooled liquids as glasses from orbit and growing single crystals on earth is discussed. Author

N70-14664*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FACILITY FOR SPACE EXPERIMENTS M512 AND M479
P. G. Parks *In its* Space Process. and Manuf. Meeting 21 Oct. 1969 p 253 262 (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

The capability for conducting Space Manufacturing Engineering Experiments during an Earth-orbital mission are contained within a completely integrated system. This versatile system provides the facility for conducting six experimental tasks and consists of a vacuum work chamber, a control panel and a 2 kilowatt electron beam welding and heating system. This experimental facility is shock mounted on a vibration dampening panel and attached to the M.D.A. longerons in a vertical position. The work chamber is vented through the outer wall of the M.D.A. to provide a vacuum of 2 $\times$ 10 minus 4 torr required for the experiments. Author

N70-14665*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METALS MELTING AND EXOTHERMAL HEATING
Robert V. Hoppes *In its* Space Process. and Manuf. Meeting 21 Oct. 1969 p 253–262 (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

Two of the experimental tasks approved as part of M512 space experiment are Metals Melting (Electron Beam Welding) and Exothermal Heating (Tube Brazing). The two tasks have similar objectives: (1) to learn about the behavior of molten metal in a reduced gravity environment; (2) to demonstrate two heat sources for melting materials in space; and (3) to establish a method of joining and repairing. Four materials will be used in the first task - SS, Ti, Al, and TDNi. A beam of constant power density will impinge on a revolving plate with a melt circle diameter of seven inches. In the second task, sixteen SS tubes will be joined by brazing, using exotherm heat sources. Author

N70-14666*# Little (Arthur D.), Inc., Cambridge, Mass.
SPHERICAL FORMING AND COMPOSITE CASTING IN ZERO-G
A. E. Wechsler, J. Berkowitz-Mattuck, P. C. Johnson, and L. B. Griffiths *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 271 296 (See N70-14651 04-15)
(Contract NAS8-21402)
Avail: CFSTI CSCL 13H

The formation of spheres in the zero-g environment of an orbitting spacecraft has the potential for enhancing the surface finish, hardness, sphericity and microstructural properties. Casting of composites has the potential for better fiber alignment and a more homogeneous structure which could lead to improved strength or unique physical properties. This paper describes a program conducted to assist in the identification and selection of materials and methods for the spherical forming and composite casting experiments of the AAP Workshop. Author

N70-14670*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NEW DEVELOPMENT IN SPACE MANUFACTURING
Hans F. Wuenscher *In its* Space Process. and Manuf. Meeting 21 Oct. 1969 p 337 345 (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

The progress in space manufacturing development is reviewed. The possibilities of processes in zero and low "g" environment have been considered in industry, at universities and research institutes, and government agencies. Areas of interest stimulated conceptual studies and evaluation of economical aspects. In-depth assessment of feasibility is underway. The tabulation of unique space processes is brought up-to-date. New processes which have emerged are discussed. The present coverage by research and technology development toward space experiments is assessed, and recommendations for future development areas are given. Author

N70-14672*# General Dynamics Corp., San Diego, Calif.
COMPOSITE CASTING SUPERIOR STRUCTURAL MATERIALS THROUGH THE COMBINED APPLICATION OF UNIQUE ZERO-G EFFECTS
W. H. Steurer *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 351 374 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

Composite casting is of particular interest for the demonstration of space manufacturing capabilities in early experiments, since it: (1) permits the application of basic zero-g processing concepts in a variety of effective combinations; and (2) has a high assurance of experiment success. The purpose of this discussion is to assess the effectiveness of various modifications and to propose specific experiments. The basic process, which employs primarily the zero-g phenomenon of mixture stability, comprises two methods: mold casting and free casting. The attainable end-product properties are determined by proper selection of matrix and reinforcement materials and by optimization of reinforcement shape, size and packing. Further improvement of properties may be achieved by individual or combined application of modifications. Author

N70-14673*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEAT SOURCES FOR SPACE MANUFACTURING PROCESSES
John R. Rasquin *In its* Space Process. and Manuf. Meeting 21 Oct. 1969 p 375–382 (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

This paper examines the various possible heat sources for manufacturing processes requiring heat in the environment of space and zero-G and makes a rough analysis of the usefulness of the heat sources with respect to weight, bulk, power requirements, reliability, safety of operation, and cost where applicable to any of the various manufacturing process experiments proposed for the AAP program. The analysis of the heat sources is not too detailed or accurate because not enough is known at this time about which materials are to be processed. This paper also assumes that a primary source of electric power is available, large enough to meet the demand in each instance. Author

N70-14675*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STUDIES OF ZERO-GRAVITY EFFECTS ON SOLIDIFICATION
T. C. Bannister *In its* Space Process. and Manuf. Meeting 21 Oct. 1969 p 390 402 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 13H

The major activities recently initiated in support of the manufacturing in space effort will be discussed. These efforts are primarily aimed toward scientifically defining the role of gravity in the various processes involving solidification. A motion picture of the solid/liquid interface of several transparent freezing materials will be shown. Author

N70-14679*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THEORETICAL CONSIDERATIONS FOR LIQUID PHASE SINTERING AND SOLIDIFICATION IN THE SPACE ENVIRONMENT

Richard Fabiniak, Thaddeus Fabiniak, Eugene Mc Kannan, and Robert Abbott *In its* Space Process. and Manuf. Meeting 21 Oct. 1969 p 448–468 refs (See N70-14651 04-15)

(Contract NAS8-24952)

Avail: CFSTI CSCL 13H

Sintering and joining processes involve two steps: First a solid-solid phase and then a liquid-solid phase. Analysis of these processes shows that the first step is dependent on diffusion coefficients, vacancy concentrations in the bulk, surface energy and contact geometry, in addition to time and temperature. The second step is dependent on surface adsorption controlled by crystal faceting, grain boundary grooving, and thermal etching. Knowledge of these specific material properties from laboratory experiments will help to define the specific effects of gravity separated from the effects of the gaseous environment in space. Author

N70-14695# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MACHINE FOR STUDYING FRICTION OF BALLS INSIDE A RACER

N. M. Alekseev et al 7 May. 1969 5 p Transl. into ENGLISH from Russian Patent no. 186183 (Appl. no. 930789/25-28, 25 Nov. 1964) 2 p

(AD-693829; FTD-HT-23-1402-68) Avail: CFSTI CSCL 14/2

The document covers the feasibility of a machine for studying the friction of balls inside a racer for a long time under permanent conditions. Author (TAB)

N70-14699# Michigan Univ., Ann Arbor. Dept. of Naval Architecture and Marine Engineering.

INSTABILITY OF PLANING SURFACES Technical Report, 1 Jan.–30 Apr. 1969

Francis T. Ogilvie Jul. 1969 36 p refs

(Contract N00014-67-A-0181-0019)

(AD-694491; Rept-026) Avail: CFSTI CSCL 13/10

A mathematical analysis is developed for the hydrodynamic problem of a two-dimensional planing surface which is heaving sinusoidally. From the assumptions of small angle of attack and small amplitudes of motion, it is possible to formulate a linear problem. Gravity is neglected. A condition is developed for predicting instability of the steady forward motion. Author (TAB)

N70-14724# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TAE TEMPERATURE REGIME OF HEAVILY LOADED BEARINGS

A. A. Kutukov 20 May 1969 8 p refs Transl. into ENGLISH from Politekhnicheskii Inst. Novocherk. Tr., (USSR), v. 160, 1966 p 35–38

(AD-694184; FTD-HT-23-52-69) Avail: CFSTI CSCL 13/9

The report gives the results of the experimental investigation of the temperature regime of heavily loaded sliding bearings operating with negligibly low heat exchange in the external medium. The investigation was made for bearings having relative length equal to unity; for processing the results, methods of the theory of physical similarity were used. Author (TAB)

N70-14747# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TOOL FOR CALKING THE SURFACES OF PARTS

B. U. Yashin 30 Apr. 1969 6 p Transl. into ENGLISH from Russian Patent no. 190396 (Appl. No. 1031329/22-1, 1 Oct. 1965) 2 p

(AD-695928; FTD-HT-23-1404-68) Avail: CFSTI CSCL 11/8

A tool is known for surface hardening of parts by the calking method; it consists of housing, a drive, a buffer device, and a firing pin. As distinguished from the known one, in the described tool on the firing pin there are fastened a guide sleeve and a round cone. The sleeve assures the positioning of the working surface of the head in a plane perpendicular to the lines of the teeth, and the cone assures the necessary relative movement of the pin and the part being machined. This makes possible the machining of the notches of the slanting and straight teeth of cylindrical gearwheels. Author (TAB)

N70-14787# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HYDRODYNAMIC THEORY OF THE LUBRICATION OF POROUS BEARINGS

B. I. Byalyi 3 Apr. 1969 13 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniy Mashinostr. (USSR), no. 1, 1968 p 70–75

(AD-695235; FTD-HT-23-1305-68) Avail: CFSTI CSCL 13/9

A method is proposed for the analysis of porous metal-ceramic bearings of finite length using an approximate boundary condition to relate the velocity and pressure differential on the lubricant layer-bearing interface in the form of Darcys law. Determination of the pressure distribution function in the lubricant layer is resolved to the joint solution of a Reynolds equation containing a term to take into account the porosity of the bearing and a Laplace equation describing the pressure distribution within the body of the bearing itself. Numerical values for the nondimensional bearing capacity are assigned. TAB

N70-14833# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TEMPERATURE DEPENDENCE OF EXTERNAL FRICTION IN ROLLING OF M3 COPPER

V. P. Severdenko et al 23 Apr. 1969 9 p refs Transl. into ENGLISH from Akad. Nauk. Belorussk. SSR (Minsk), v. 11, no. 4, 1967 p 327–329

(AD-695328; FTD-MT-24-465-68) Avail: CFSTI CSCL 13/8

Annealed Cu plates 5 × 40 × 200 mm. were rolled at 20-810 degrees to 10, 20 and 30 percent reduction. The friction coefficient were determined simultaneously by forward slip, torsional moment, and inclined dynamometer methods. For all degrees of reduction the Friction Coefficient decreased to a minimum at 100 degrees rolling temperature, which is due to the formation of cupric oxides. Plates rolled to 10-20 percent reduction also showed 2 maximum on the Friction Coefficient vs. rolling temperature curves, at 360 and 560 degrees plates rolled to 30 percent showed only one maximum at 550 degrees. Increasing the time of heating the plates from 0.7 to 2.5 hrs at 450 and 650 degrees had little effect on the Friction Coefficient. The maximum at 360 and 560 degrees are probably due to changes in the nature of oxides. Author (TAB)

N70-14868# Army Edgewood Arsenal, Md. Industrial Operations Div.

NUMERICAL CONTROL: EPOXY PINISHING Special Publication

Louis W. Rehberger Sep. 1969 16 p ref

(AD-695613; EASP-400-23) Avail: CFSTI CSCL 13/9

The paper deals with an improved technique used to manufacture a fixture made of aluminum-filled epoxy casting resin for precast castings of irregular configurations in the numerical control metal working facilities at Edgewood Arsenal. Specific examples are illustrated, as well as the latest techniques of checkout by digital coordinate measuring device. It is not intended that these

developments of epoxy fixturing provide the answers to all machine fixturing problems, but as ascertained, the solution and significant improvements are possible for the precision castings being produced and used at Edgewood Arsenal, Maryland. The cost of producing these items by conventional means would have been four times greater than producing them by epoxy fixturing. In epoxy fixturing, it has been proven that tangible benefits were realized by elimination of individual fixtures. The feasibility of incorporating a combination of components of variable configuration has been successfully developed and implemented. Time and cost savings are apparent through the increased productivity and consistent quality of the items produced. Author (TAB)

N70-14864# National Research Council of Canada, Ottawa (Ontario).
THE GEOMETRY OF THE THEORETICAL MESH CONDITIONS OF TOOTH SURFACES GENERATED BY MEANS OF A TORUS-SHAPED TOOL SURFACE
I. Drahos 1969 23 p refs Transl. into ENGLISH from Acta Tech. Acad. Sci. Hung. (Budapest), v. 54, nos. 1/2, 1966 p 101–124
(NRC-TT-1380) Avail: CFSTI

Cylindrical gears can be generated on the Forster-type gear cutting machine and bevel or hypoid gears on the Gleason-type gear cutting machine according to the Wildhaber-Novikov principle. The tooth surfaces of the respective generating tools, the rock and the crown gear, are rotational torus surfaces with the generating circle as the line of contact. These teeth can also be machined by means of a cup-type grinding wheel with a circular profile. Author

N70-14969# Army Edgewood Arsenal, Md. Plans and Readiness Operations Office.
WHY NOT GO NUMERICAL CONTROL?
Lyle L. Dauber Sep. 1969 14 p
(AD-695611; EASP-600-6) Avail: CFSTI CSCL 13/8

The report gives a number of reasons why one should adopt numerical control (N/C) manufacturing techniques. Author (TAB)

N70-14966*# Southeastern State Coll., Durant, Okla. Technology Use Studies Center.
APPLICATIONS OF HYDRAULIC COMPONENTS
Nov. 1969 14 p refs *Its* Technology Fact Bull. No. 1
(Grant NSR-37-004-008)
(NASA-CR-107474) Avail: CFSTI CSCL 13G

New hydraulic techniques are described and possible areas of application are outlined. This report discussed six fluid-control devices or hydraulic components: (1) the hydraulic accumulator, (2) the hydraulic force amplifier, (3) a sequence valve, (4) a hydraulic fuse, (5) a servo valve, and (6) a priority valve. Basic schematics of the more widely used components are provided. R.B.

N70-14980# National Research Council of Canada, Ottawa (Ontario).
THE PROBLEM OF UNIFORMITY IN THE OPERATION OF NODULIZING PANS
K. Kayatz 1969 13 p refs Transl. into ENGLISH from Zement-Kalk-Gips (Wiesbaden), v. 17, no. 5, 1964 p 183–187
(NRC-TT-1392) Avail: CFSTI

The degree of uniformity of nodules desirable for the burning process cannot always be attained. Apart from variations in the nodulizing capacity of the raw meal, the causes must be sought in the mode of operation of the nodulizing equipment. This has been exhaustively investigated. The factors affecting the growth of the nodules were studied. Moistening and the distribution of the meal, as well as the uniformity of feed, determine the size of the nodules. Author

N70-14997# Michigan Univ., Ann Arbor. Inst. for Social Research.
THE CONDITIONING EFFECTS OF TECHNOLOGY ON ORGANIZATIONAL BEHAVIOR IN PLANNED SOCIAL CHANGE
James C. Taylor 30 Sep. 1969 109 p refs
(Contract N00014-67-A-0181)
(AD-694995) Avail: CFSTI CSCL 5/11

Existant literature has suggested that sophisticated production technology tends to provide forces in the direction of increased work group autonomy, decision making and responsibility. The document presents a brief discussion of technology as a potential lever in organizational change, dealing with the notion of interrelatedness of subunits in organizational reaction to external change forces. These conclusions have resulted in the hypothesis that if sophisticated production technology leads to greater worker participation, and if this can be used as a force in planned organizational change in the direction of greater worker participation, then planned change will be facilitated. A new model of technological classification is given -- one including elements of raw material input, and output control, as well as machines. Author (TAB)

N70-15010# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE IMPULSE OPERATIONAL-DISPATCH CONTROL SYSTEM FOR A METALLURGICAL COMBINE SECTION
Yu. S. Valdenberg et al 2 Apr. 1969 25 p refs Transl. into ENGLISH from Russian publ.
(AD-694818; FTD-MT-24-43-69) Avail: CFSTI CSCL 13/8

The article describes the impulse control system and the control algorithm developed for steel mill operations between the open hearth section and the blooming mill. A structural diagram of the system consisting of a control computer at the higher level and automatic railroad devices, visual signal display unit, manual input terminals, and locomotive and sensors at the lower level is presented. TAB

N70-15018# Martin Marietta Corp., Denver Colo.
CENTER FOR HIGH ENERGY FORMING
Jimmy D. Mote Aug. 1969 46 p Prepared in cooperation with Denver Univ.
(Contract DA-19-066-AMC-266)
(AD-695709; AMRA-CR-66-05120) Avail: CFSTI CSCL 13/8

Topics included are: Computer programs; Mechanics of high velocity metal deformation; Mechanics of energy transfer; Strain rate effects; Effect of clamp stiffness on flange buckling; Electromagnetic and electrohydraulic forming; Explosive welding and cladding; Phase transformations, grain growth, and aging; Fatigue and fracture toughness properties of iron and titanium base alloys; Effect of explosive forming on stress corrosion of aluminum-, titanium-, and iron based alloys; Formability of dual-hardness roll bonded steel plates. TAB

N70-15034# Army Chemical Center, Edgewood Md.
WHAT IS WELDING
Francis B. Gurtner Aug. 1969 38 p refs
(AD-695614) Avail: CFSTI CSCL 13/8

The work characterized in the report is an accumulation of information, experience, knowledge, and scientific endeavor which resulted from a study of 10 years or more in the field of welding and metallurgy and associated fields of sciences. Author (TAB)

N70-15059*# Aerojet-General Corp., San Ramon, Calif.
BOLT INSTALLATION AND REMOVAL TOOL Final Report
Sep. 1969 37 p
(Contract NAS8-30026)

(NASA-CR-61315; AN-1709) Avail: CFSTI CSCL 13I

A tool for performing under adverse conditions was developed. Two models or prototypes were developed for underwater use and simulated space station use; with further refinement and development, a space qualified tool can be realized to meet all of the environment conditions that will exist in an orbiting space platform or station. Author

N70-15136 Cincinnati Univ., Ohio.

STATIC AND DYNAMIC RESPONSE OF TORSIONAL SYSTEMS

Sheau-ming Wang (Ph.D. Thesis) 1968 251 p

Avail: Univ. Microfilms: HC $11.50/Microfilm $3.25 Order No. 69-6364

A method of analysis of torsional systems is developed for solution by high speed digital computers. This method will give the static and dynamical torsional response of general mechanical systems. The method constructs, directly from drawings, all equations necessary for the solution of the problem. Effects that can be included consist of the gear teeth stiffness, key stiffness, gear web stiffness, mass moment inertia and torsional flexibility of complex cross section shafts, external torques, special types of joints, general boundary conditions, etc. Experimental studies of the torsional response are also presented. Dissert. Abstr.

N70-15186# Army Foreign Science and Technology Center, Washington, D.C.

SURFACE-EFFECT VEHICLES

N. I. Belavin 1969 174 p refs Transl. into ENGLISH from Russian book

(AD-694582; FSTC-HT-23-437-69) Avail: CFSTI CSCL 13/10

The book presents a brief history survey of the development of a new means of transportation - surface-effect vehicles - and various types of these vehicles constructed abroad are described. The main features of near-surface aerodynamics, on the basis of which are created high-speed surface effect vehicles, are considered. Classification and description are presented of basic design features of foreign surface-effect vehicles, their hulls, power plants and starting devices, and also the results of testing these crafts. Their seaworthiness and problems of flight stability are considered. Finally, the aerodynamic and power advantages of surface-effect vehicles and their position in the overall system of vessels and crafts using new principles of motion, and also the short-range prospects of surface-effect vehicle development are shown. Author (TAB)

N70-15193 Purdue Univ., Lafayette, Ind.

A STRESS AND VIBRATION ANALYSIS OF A LEAF-TYPE COMPRESSOR VALVE

Allan George Doige (Ph.D. Thesis) 1966 176 p

Avail: Univ. Microfilms: HC $8.20/Microfilm: $3.00 Order No. 69-8697

The suction valve dynamics and the usefulness of this mathematical model as a design tool were studied. Experimental tests showed that a superposition of normal beam modes was adequate to describe valve motion and stress. Strain measurements at selected points on the valve were used to get the instantaneous distribution of strain, from which the contributions of the various modes of vibration could be calculated. Further analysis resulted in a simplified energy equation which could be used to predict qualitatively, the effect of the design parameters of valve thickness and stop depth on maximum strain. This maximum potential energy concept can be applied to other valve configurations and compressor designs as well. The nature of the valve forcing function was investigated by means of calculations from measured displacement. These results were compared with force estimates using pressure differentials and an effective area, determined experimentally. Dissert. Abstr.

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-14181# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LG-55 AND LG-56 GAS LASERS

26 Mar. 1969 5 p Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 7, no. 5, 1967 p 798 - 799

(AD-695207; FTD-HT-23-1198-68) Avail: CFSTI CSCL 20/5

The LG-55 is a source of coherent monochromatic visible radiation intended for use in precision optical range finders, for the investigation of optical modulators, for quality control, for adjustment of optical systems, and for various scientific purposes. The laser consists of an optical resonator (mirrors in adjustable mounts) and an active element (gas discharge tube) in a three-rod mounting placed in a protective jacket. The laser operates in a multimode regime, but its spectrum does not have any difference frequencies in the range 1 -- 50 MHz. The emission wavelength is 6328 angstrom unit, the output power not less than 2 mW. The LG-56 is similar to LG-55 but has higher mechanical and thermal stability. TAB

N70-14194# Lockheed Missiles and Space Co., Sunnyvale, Calif.

INFRARED RADIATION OF A DISCHARGE TUBE USED IN A CO2 LASER

E. N. Lotkova and V. N. Ochkin [1969] 3 p refs Transl. into ENGLISH from Zh. Prikl. Spektr., (Russian), v. 11, no. 4, 1969 p 739—741

Avail: CFSTI

The infrared radiation spectra of molecules in a 1 m long and 34 mm diameter discharge tube of a CO2 laser in the four to five micron band was recorded. The radiation spectra of CO2 and CO in the stationary and continuous systems were compared at different pressures and initial gas mixture compositions. A transmission diffraction monochromator with 100 lines per millimeter grating was utilized. Recording was by an InSb detector cooled by liquid nitrogen. The surveys were taken from the endface of the discharge tube. R.B.

N70-14206# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE FINE SPECTRAL STRUCTURE OF RUBY LASER EMISSION

Yu. P. Safronov, V. I. Telnykh, Ya. A. Sukhanov, V. A. Polurshinov, and I. V. Maksyutov 31 Jan. 1969 6 p Transl. into ENGLISH from Svetotekhnika, (Russian), v. 14, no. 1, 1968 p 1 12

(AD-694812; FTD-HT-23-712-68) Avail: CFSTI CSCL 20/5

Radiation from a RAZDAN-type ruby laser was investigated using an ASP-20 horizontal, sun-diffraction spectrograph, which permits wave study in the 3000-11000 A range with a resolution of 0.017 A in the red band. The study established that ruby laser radiation is not monochromatic but contains a series of spectral line-modes within a 0.6 A range. A photometric cross section of pulse spectrograms was prepared in order to compare the radiation intensity of separate modes from pulse to pulse. TAB

N70-14219*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

WAVELENGTH DEPENDENCE OF LASER BEAM SCINTILLATION

M. W. Fitzmaurice, J. L. Bufton, and P. O. Minott Washington Dec. 1969 11 p refs

(NASA-TN-D-5533) Avail: CFSTI CSCL 20E

The proportionality of log-amplitude variance and the 7/6 power of wave number predicted by Tatarski for horizontal propagation from a spherical-wave transmitter to a point detector was confirmed. The validity of this proportionality was tested for two wavelengths, 0.632 and 10.6 microns. A 0.632 microns He-Ne laser and a 10.6 microns CO2 laser transmitter were operated simultaneously over a folded 1.1-km horizontal path, and the beams were detected by a photomultiplier and a gold-doped germanium detector. The primary scintillation statistic, log-amplitude variance, was evaluated for each wavelength on a digital computer. The ratio of variances at 0.632 and 10.6 microns was in close agreement with predictions. Power spectral density, autocorrelation, and cumulative probability density also were evaluated for each wavelength. Scintillation statistics at 10.6 microns were found to be log-normal, just as in the visible portion of the spectrum. Author

N70-14242# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF EMISSION FROM AN OPTICAL QUANTUM GENERATOR ON METALS

A. M. Bonch-Bruevich and Ya. A. Imas 30 Jan. 1969 215 p refs Transl. into ENGLISH from Fiz. i Kaim. Obrabotki Materialov, (Russian), no. 5, 1967 p 3–10

(AD-695229; FTD-HT-23-753-68) Avail: CFSTI CSCL 20/5

The light beam of a laser is focused by lens onto metal surface. High-speed movie camera records the development of the vapor jet and hole in the metal. The laser oscillator consists of an active neodymium glass rod 25 mm in diameter and 500 mm long excited by 5 helical flash lamps. The shape, diameter, and depth of the hole blasted in the metal were found to depend in a complex manner on the parameters of the laser pulse. TAB

N70-14288*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

PHOTOGRAPHY OF A SATELLITE REFLECTING LASER BEAMS [PHOTOGRAPHIE DES ECHOS LASER SUR SATELLITES]

Georges Jacovlev Washington NASA Dec. 1969 7 p refs Transl. into ENGLISH from Rech. Aerospatiale (Seine), no. 123, Apr. 1968 p 85–87

(Contract NASw-1692)

(NASA-TT-F-12726) Avail: CFSTI CSCL 20E

The equipment and methods used in an experiment on instantaneous position determination of a satellite by laser light pulses is described. The recorded results prove the possibility of this type of photography for this purpose. Author

N70-14393# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROBLEM OF A LASER WHICH IS STIMULATED BY HARD RADIATION

V. L. Vinetskiy 24 Jul. 1969 13 p refs Transl. into ENGLISH from Soveshchaniye Po Radiatsionnoy Fiz. Nemetallicheskikh Kristallov. Kiev, 1965. Radiatsionnaya Fiz. Nemetallicheskikh Kirstallov. Trudy (Kiev), 1967 p 92–105

(AD-695944; FTD-MT-24-27-69) Avail: CFSTI CSCL 20/5

A short analytical review is made of semiconductor lasers pumped by hard radiation (e.g., electron beam). The review consists of three sections: possible transition schemes; generation threshold in the stationary regime; and free carrier absorption. TAB

N70-14694# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOLAR PHOTORESONANT EXCITATION OF SEMICONDUCTOR LASERS AND PHOTOLUMINESCENT DEVICES

P. M. Karageorgiy-Alkalayev 17 Jul. 1969 12 p refs Transl. into ENGLISH from Geliotekhn. (USSR), no. 2, 1968 p 9–17

(AD-694819; FTD-MT-24-72-69) Avail: CFSTI CSCL 20/5

After reviewing briefly the various difficulties encountered in previous efforts to use sunlight for laser pumping, the authors show that one possible way of producing effective pumping is to produce resonant interaction between modulated sunlight and plasma waves in a semiconductor laser. The conditions for the occurrence of such waves by double injection are derived, and the method whereby sunlight modulated in space and in time resonate with the plasma waves to produce regions of unusually high carrier density sufficient to produce the stimulated emission in the semiconductor, is described in detail. TAB

N70-14711# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

PASSIVE FEEDBACK CONTROL IN A RUBY LASER

J. C. Stover and I. C. Chang Aug. 1969 67 p refs

(Contract N00014-67-A-0226)

(AD-693986; TR-EE-69-31) Avail: CFSTI CSCL 20/5

This research investigates the feasibility of pulse stretching in a Q-switched ruby laser by means of passive feedback control. Control of pulses with half widths of less than 300 nanoseconds is of special interest as this cannot be accomplished with presently existing active feedback systems due to the delay time involved. Intuitively it is felt that inserting a loss into the laser cavity that increases with laser power would limit the peak spike power. If the spike energy remains constant an increase in spike width will result. Two such loss systems are reported here. One is a loss due to the frequency discrimination of the laser linewidth. Laser power is shifted in frequency by stimulated Rayleigh wing scattering to higher loss sections of the linewidth. The amount of shift and the amount of power shifted are power dependent. The second system involves discrimination on the basis of polarization. The induced rotation of the polarization ellipse associated with self-focusing is used. The Rayleigh effect produces control at lower power levels than the induced polarization rotation system. Author (TAB)

N70-14840*# Sylvania Electronic Systems-West, Mountain View, Calif. Research and Development Dept.

SPACE QUALIFIED CO2 LASER. PHASE 1: DESIGN Final Interim Technical Report, 18 Nov. 1968 – 18 Sep. 1969

Richard S. Reynolds Dec. 1969 99 p refs

(Contract NAS12-2021)

(NASA-CR-86299) Avail: CFSTI CSCL 20E

This report presents the preliminary detail design of a 1 watt, space qualified carbon dioxide laser. The laser tube utilizes a beryllium oxide ceramic structure for enhanced heat removal and is conduction cooled. The tube has gallium arsenide Brewster windows so that in cavity optical components can be added if required. The laser head has a design weight of 5.9 lbs and measures 12 × 4 × 4 inches. The design employs an external power supply which has a design weight of 4.2 lbs and measures 2 × 4 × 9 inches. A new metal soldering technique was developed with GaAs windows and the laser tube. The laser is equipped with a piezoelectric mirror transducer so that manual or atuomatic control of the laser frequency is possible. Experimental studies on mock up lasers have shown that an overall efficiency of about 7% or better is possible with close attention to the detailed tube design. Continuing life studies have resulted in over 3400 hours of operating life at less than 25% reduction in initial power output. To achieve these lifetimes, a continuously heated nickel cathode was used. Author

N70-14820*# Northeastern Univ., Boston, Mass.

THE STUDY OF OPTICAL PROPERTIES AND COLLECTIVE OSCILLATIONS IN NEW SOLID STATE MATERIALS AND AS A FUNCTION OF TEMPERATURE USING INFRARED AND RAMAN TECHNIQUES Quarterly Progress Report, 16

Aug. – 15 Nov. 1969
Clive H. Perry 15 Nov. 1969 14 p refs
(Grant NGL-22-011-051)
(NASA-CR-107476; QPR-2) Avail: CFSTI CSCL 20E

The work accomplished on the investigation of the optical properties and oscillations in solid state materials is reported. The instrumentation difficulties and solutions are discussed. The design of a variable temperature gas transfer cell for use in solid state spectroscopy is described, which is capable of controlling and varying temperatures from 20 to 300K. The cell is considered very versatile, and has been used in infrared investigations with Perkin Elmer grating instruments, and Bechmen, and Michelson interferometers. F.O.S.

N70-14978*# Arkansas Univ., Little Rock. Dept. of Electronics and Instrumentation.
INVESTIGATION OF LASER PROPERTIES RELEVANT TO THE MEASUREMENT OF DIFFERENT PHYSICAL PARAMETERS Informal Status Progress Report
M. K. Testerman 30 Sep. 1969 82 p refs
(Grant NGL-04-001-007)
(NASA-CR-107481) Avail: CFSTI CSCL 20E

The separate reference beam method of double exposure holographic interferometry is investigated to study new techniques for measuring smaller phase changes in interference fields. A specific technique, and the fabrication of the system are described. The construction, operation, and calibration of a spatial frequency spectrum analyzer is also described. In addition, low-noise, high primary quantum efficiency photo processes are investigated for improving contrast amplification. An outline of the work performed on the characterization of turbulent flow by optical methods, and the experimental results are included. F.O.S.

N70-14982*# Columbia Univ., New York. Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report, 1 Nov. 1968 – 31 Aug. 1969
V. M. Bennett, ed. 31 Aug. 1969 78 p refs
(Grants NGR-33-008-009; NGR-33-008-012; NGR-33-008-102)
(NASA-CR-107439; PR-19) Avail: CFSTI CSCL 20E

A series of photon-echo experiments was performed in ruby at laser pulse intervals of 0.9 micron/sec, which is a considerably longer time interval than has previously been used. The echoes observed had characteristics somewhat similar to those of preceding experiments, but a stronger magnetic field was necessary to inhibit relaxation during the longer interval. A general theory to explain spin- and photon-echo behavior in ruby was developed. A detailed description is given of an experiment in which a coincidence technique is used to detect photons emanating from atoms excited by electron impact and the associated electrons inelastically scattered in the forward direction. With this method, the exact value of threshold polarization can be measured. The ion-beam apparatus for measurement of differential cross sections for inelastic scattering was assembled and tested. With the cylindrical energy analyzer, observation was made of elastic and inelastic scattering; in addition, successful tests were made of the optical and the electronic data-acquisition systems. Author

N70-15184 Army Foreign Science and Technology Center, Washington, D.C.
POLARIZATION OF LASER EMISSION SCATTERED BY FOG AND SMOKE
M. V. Kabanov 14 Oct. 1969 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana (Moscow), v. 4, no. 10, 1968 p 1116–1119
(AD-695958; FSTC-HT-23-635-69) Avail: CFSTI CSCL 20/6

The results of experimental investigations of the degree of polarization of scattered forward and reflected light are discussed, including laser-emission in artificial fog and smoke. Results obtained show that during dispersion of narrow laser beams the theory of momentary scattering describes not only the dependence of scattered light intensity on optical thickness, but also the polarizing ability of scattered forward light. Author (TAB)

N70-15434# General Telephone and Electronics Labs., Inc., Bayside, N.Y.
SCANNED LASER DISPLAY TECHNIQUES
Vernon J. Fowler *In* AGARD Displays for Command and Control Centers Jul. 1969 p 373–387 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI

A brief survey is presented of the present status of research on display techniques utilizing scanned and modulated multicolor laser beams. A major advantage of lasers for projection display applications is their unique ability to project small spots of extremely high intensity on a remote screen. Spots projected from incoherent sources are, of necessity, less bright than their sources. Free of this restriction, lasers can produce projected spots orders of magnitude brighter than those produced by any incoherent source. Problems associated with the generation, modulation, and scanning of multicolor laser beams are discussed, along with descriptions of some techniques now in use in experimental scanned display systems. A new system is described which produces three-color projected images, using a closed-loop method for generating the color video signal. Author

N70-15435# Army Electronics Command, Fort Monmouth, N.J.
DIGITAL ELECTRO-OPTIC DEFLECTOR FOR DIRECTING LASER BEAMS
Pierce W. Siglin and Erich F. Kral *In* AGARD Displays for Command and Control Centers Jul. 1969 p 389–403 refs (See N70-15408 04-08)
Copyright. Avail: CFSTI

The design of a high resolution digitally indexed laser beam deflector is described which, in the ultimate state, will provide 1024 discrete beam positions in both an x and a y direction. Electro-optic switches, split angle, Wollaston prism, and total internal reflection deflector elements are discussed. Plans are outlined for continuation of the development effort to achieve broad-band operation of the deflector over the visible spectrum. Author

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-14113# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS ARISING FROM THE THEORY OF HEAT-RESISTANCE ALLOYS
I. I. Kornilov 4 Feb. 1969 20 p refs Transl. into ENGLISH from Svoistva i Primenanie Zharoprochnykh Splavov. (Moscow), 1966 p 3–15
(AD-694747; FTD-HT-23-110-68) Avail: CFSTI CSCL 11/6

The article considers the solubility and dispersion mechaniams for strengthening refractory metals. The main aim of the article is a consideration of the possibility of creating new heat resistant alloys based on the refractory metals, in particular the big four, columbium, tantalum, molybdenum, and tungsten. A table presents calculated critical temperatures for the above metals. On the basis

of the experimental data presented, the following factors must be considered in the application of solution and dispersion effects in the strengthening of alloys: (1) Use should be made of the great tendency of the transition metals, including the big four, toward the formation of a wide range of solid solutions. For alloys of this kind, the basic systems are tungsten-tantalum-molybdenum-columbium and tungsten-molybdenum-columbium-vanadium. (2) Using the ability of these metals to combine with light metals and metalloids (aluminum, beryllium, boron, carbon, silicon, nitrogen) to form limited solid solutions and high melting compounds (aluminides, beryllides, borides, carbides, silicides, nitrides), these metals should be used for alloying multicomponent alloys. TAB

N70-14114# Army Foreign Science and Technology Center, Washington, D.C.

MEASUREMENT OF THERMAL PROPERTIES OF SOLID AND LIQUID METALS AT HIGH TEMPERATURES

L. P. Filippov 17 Sep. 1969 444 p refs Transl. into ENGLISH from Izmen. Tepl. Svoistu Tverdykh I Zhidkikh Metallov Pri Vysokikh Temperaturakh, (Moscow), 1967 p 325

(AD-695097; FSTC-HT-23-395-68) Avail: CFSTI CSCL 11/6

Contents: General problems of the procedure and the experimental technique; Steady methods for measuring the heat conductivity of metals; Non-steady methods for measuring thermal properties; Heat capacity of metals; Heat conductivity of metals. TAB

N70-14148# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

WEAR RESISTANCE OF HIGH-CHROMIUM STEELS IN AN AIR-ABRASIVE MEDIUM AT HIGH TEMPERATURES

K. I. Vashchenko et al 14 Feb. 1969 12 p refs Transl. into ENGLISH from Tekhnol. I Organizatsiya Proizv. (USSR), no. 4, 1967 p 107 – 109

(AD-695184; FTD-HT-23-1059-68) Avail: CFSTI CSCL 11/6

The effect of chromium, aluminum and silicon on the wear of high-alloy chromium steels in abrasive media at high temperatures has been investigated. The steels were melted in high-frequency furnace and cast into specimens 50 mm in diameter and 10 mm thick. The effect of chromium content on the abrasive wear was tested on steel specimens containing 0.35% carbon, 3.1% aluminum, 0.8% silicon, 0.3% manganese and 12--30% chromium. Author (TAB)

N70-14159# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A METHOD FOR INVESTIGATING THE DEGASIFICATION PROCESS OF STEEL DURING VACUUM TREATMENT

E. S. Lenin et al 30 Jan. 1969 6 p Transl. into ENGLISH from Akad. Nauk SSSR, Inst. Met., Ekperim, Tekhn. I Metody (Moscow), 1966 p 102 – 104

(AD-694813; FTD-HT-23-685-68) Avail: CFSTI CSCL 11/6

The apparatus and procedure are described for sampling molten steel during vacuum degassing, consisting essentially of a quartz tube sampler which can be immersed into molten steel, taking a sample, and withdrawing it without breaking the vacuum. Before sampling a piece of Al wire is placed into the tube to react with the oxides. Samples can be taken at a rate of one every 30 sec. The samples are cooled and placed into calibrated eudiometers filled with alc.; after 5 days, the amt. of evolved H is measured and the amt. of residual H is detd. by vacuum heating. Essentially, the method det. gas content remaining in the metal rather than the gas evolved; it can be used for detg. other gases or for complete chemical analysis. TAB

N70-14164# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Applied Materials Research Branch.

COMPARISON OF TRANSITION TEMPERATURES INDICATED BY CHARPY 5 NOTCH AND SUB-SIZE IZOD IMPACT SPECIMENS FOR IRRADIATED 3 1/2 PER CENT AND 9 PER CENT NICKEL STEELS

M. B. Watson and B. L. Wotton Oct. 1969 19 p ref

(AECL-3370) Avail: CFSTI

Two irradiated nickel steels were chosen for a comparative impact test study. One, a 3-1/2% nickel steel, was a material of construction in the end shields of the Douglas Point reactor. The other, a 9% nickel steel, is of interest because of its lower nil ductility temperature (NDT) before irradiation. Impact specimens of both steels were irradiated simultaneously at temperatures below 120 C with fast neutrons to a fluence of 2.5 x 10 to the 19th power n/sq cm greater than 1 MeV. The post-irradiation transition temperature of the 3-1/2% nickel steel was 85 C and 170 C, as indicated by sub-size and full-size specimens respectively. The shift in transition temperature (DELTA TT) set by the sub-size specimens was 30 C less than that set by the full-size. A similar comparison of the 9% nickel steel results indicated the difference in DELTA TT was reduced to about 15 C. The irradiated 9% nickel steel maintained its lower NDT. Author

N70-14178# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A MECHANISM DESCRIBING EFFECTS OF GRAIN BOUNDARY INTERNAL FRICTION AND SMALL AMOUNTS OF INTERSTITIAL IMPURITIES ON GRAIN BOUNDARY BRITTLENESS IN MOLYBDENUM

Yeh-Ning Wang et al 3 Apr. 1969 25 p refs Transl. into ENGLISH from Wu Li Hsueh Pao (Peking), v. 22, no. 6, 1966 p 647 – 657

(AD-694823; FTD-HT-23-1177-67) Avail: CFSTI CSCL 11/6

The grain boundary peak in molybdenum was measured by a torsion pendulum, when the frequency of vibration is 1 cps, the peak occurs around 1020 degrees C. This G. B. peak is reduced by oxygen or carbon additions, but an alloy grain boundary peak appears at the lower temperatures on the same damping curve. Using frequency of 1 cps, Oxygen peak occurs around 890 degrees C; and carbon peak occurs around 925 degrees C. Since no peak is evident on the damping vs temperature curve of molybdenum single crystals, it may be concluded that these peaks are all associated with the stress relaxation across grain boundaries. Author (TAB)

N70-14208# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper und Neutronenphysik.

MAGNETIC IMPURITIES IN METALS: THE S-D EXCHANGE MODEL

Konrad Fischer Sep. 1969 115 p refs

(JUL-616-FN) Avail: CFSTI

Impurity magnetism in metals can be investigated by the criteria for the formation and stabilization of localized magnetic moments and by the change in the various physical properties which arise from localized moments. The theory based on the equation-of-motion approach correctly describes the temperature dependence of the resistivity, thermopower, specific heat, and the susceptibility in a large temperature range. It fails to explain the temperature dependence of these quantities far below the Kondo temperature, where a too strong temperature dependence is predicted. According to this theory there are strong correlations below the Kondo temperature between the impurity spin and the spins of the conduction electrons which are far extended and impair the dynamics of the impurity spin. An explanation of the low temperature properties of the system has been attempted by theories based on the assumption of a singlet ground state. In other models which attempt to explain s-d exchange, the magnitude of the impurity spin is not assumed to be fixed a priori but is allowed to fluctuate. A model with a fixed half integral or integral impurity spin cannot adequately describe the magnetic transition metal

impurities in non-magnetic metals, since the spin values derived from the high temperature susceptibility are generally not equal to 1/2 or multiples thereof. R.B.

N70-14210# Department of Supply, Melbourne (Australia). Aeronautical Research Labs.

A COMPARISON OF EDDY-CURRENT AND POTENTIAL OR CONDUCTION TECHNIQUES IN NON-DESTRUCTIVE TESTING

I. G. Scott Mar. 1969 41 p refs

(ARL/MET-73) Avail: CFSTI

The eddy current test technique is compared with other non-destructive test techniques based on the electrical properties of the specimen, with special attention being given to the theoretical bases of these techniques. The comparison is concerned with the measurement of conductivity and material thickness, together with the detection of cracks. Author

N70-14214# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

IMPROVEMENT OF PRODUCTION TECHNOLOGY FOR THIN-WALLED FANCY-SHAPED STAINLESS-STEEL CASTINGS

Yu. Z. Babaskin et al 3 Feb. 1969 14 p refs Transl. into ENGLISH from Poroki Stal'nykh Otlivok Metody Ikh Ustraneniya, Akad. Nauk SSR, Respub. Mezhvedom. SB. (Kiev), 1966 p 122–133

(AD-695389; FTD-HT-23-691-68) Avail: CFSTI CSCL 11/6

When casting induction-melted stainless steel of the Kh18N9TL type into dry-sand molds, the thin-wall objects do not possess a sufficient impermeability because of the appearance of primary pipes, nonmetallic-inclusion pile-ups, and Ti porosity. The usual vacuum procedure is only slightly effective for stainless steels and cannot prevent the secondary oxidation and it is rather difficult to create and to maintain a high vacuum in irregularly shaped molds. The use of the neutral and reducing media or different additives with a stabilizing action fails in this case as well. The casting properties were studied as a function of the pouring temperature and the Ti content. Some preliminary investigations seem to indicate only a slight effect of temperature. Metallographic examinations reveal a great number of nonmetallic inclusions, mainly, of Ti oxides, nitrides, and sulfides, which are either homogeneously distributed or agglomerated. On the surface of fractured samples, nonmetallic inclusions are easily detectable, their concentration being directly proportional to the Ti content. When applying oxygen blowing, the most uniform distribution of impurities is attained when the highest permissible amount of Ca-Si(0.3%) is added. Author (TAB)

N70-14241# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH-TEMPERATURE STRENGTH AND PHYSICOCHEMICAL PROPERTIES OF MULTICOMPONENT NICKEL ALLOYS

L. A. Ryabtsev, I. I. Kornilov, and L. I. Pryakhina 31 Jan. 1969 10 p refs Transl. into ENGLISH from Strukt. i Svoistva Zharoprochnykh Metallicheskikh Materialov, (Moscow), 1967 p 143–147

(AD-695387; FTD-HT-23-681-68) Avail: CFSTI CSCL 11/6

A study was done on the heat resistance and physico-chemical properties of nickel alloys with compositions ranging from two to eight components. Alloying was done with 10% (by weight) chromium, 2% titanium, 6% tungsten, 3% molybdenum, 2% niobium, 5% cobalt, and from 0 to 12% aluminum. Before testing, the alloys were fully annealed to maximize the precipitation of the γ-phase. The effect of the γ-phase on the physico-chemical properties and heat resistance of the alloys was measured by electron microscopy, x-ray analysis, electrical conductivity, thermal expansion, microhardness, and rupture time at 900C and 12 kg/sq mm. Author (TAB)

N70-14270# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN PECULIARITIES OF THE BEHAVIOR OF HIGH-TEMPERATURE ALLOYS UNDER CYCLICALLY VARYING TEMPERATURES

V. I. Prosvirin et al 3 Feb. 1969 9 p Transl. into ENGLISH from the Russian

(AD-694843; FTD-HT-23-687-68) Avail: CFSTI CSCL 11/6

For aging high-temperature alloys based on nickel-chromium with titanium and aluminum, study of repeated heating is interesting from the stand-point of ascertaining the interaction between recovery and strain-hardening processes. The article presents certain data on the influence of cyclically varying temperatures on the structure and properties of EI437B alloy. TAB

N70-14275# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF INHIBITING PROPERTIES OF NITROGENOUS POLYMER COATINGS ON METALS

V. I. Zavrazhina et al 31 Jan. 1969 13 p refs Transl. into ENGLISH from Zashch. Metallov (USSR), v. 3, no. 6, 1967 p 700–704

(AD-694788; FTD-HT-23-786-68) Avail: CFSTI CSCL 11/3

The protective properties of certain water soluble nitrogen containing polymers and particularly of polyacrylamide (PAA), polyvinylpyridine (PVP) and their monomers–acrylamide (AA) and vinylpyridine (VP) were examined. Specimens of St. 3 steel were placed in solutions of sulfuric and hydrochloric acids of varying concentration which were treated with 0.2-2.0 g of the polymers per liter and the rate of dissolution (corrosion) of the metal was gravimetrically determined. It is shown that the addition of small amounts of PAA and PVP stimulates the corrosion of steel in H2 SO4, and electrolyte with a high concentration of hydrogen ions, the content of non-ionized molecules of the polymer is relatively low and hence the corrosion stimulating effect of polyanions predominates over the inhibiting effect of the non-ionized molecules of the polymer. As the concentration of H plus or minus ions decreases and hence also the concentration of non-ionized molecules increases once a certain point is reached, these polymers become corrosion inhibitors. In HCl, on the other hand, the polymers investigated consistently inhibit corrosion from the very beginning, owing to the presence of Cl ions. TAB

N70-14287# Air Force Systems Command, Wright-Patterson AFB, Ohio.

STUDY OF THE HEAT RESISTANCE OF BINARY ALLOYS OF NIOBIUM-TUNGSTEN, NIOBIUM-VANADIUM AND NIOBIUM-TITANIUM ALLOYS

Ye. V. Vasil'yeva, D. A. Porokoshkin, N. N. Popov, and E. M. Lazarev 18 Apr. 1969 13 p refs Transl. into ENGLISH from Izvest. Metally (Russian), no. 6, 1967 p 171–175

(AD-695239; FTD-MT-24-491-68) Avail: CFSTI CSCL 11/6

Niobium-Tungsten (1-15 percent tungsten), niobium-titanium (1-50 percent titanium) and niobium-vanadium (1-15 percent vanadium) alloys, melted in a vacuum arc furnace with a tungsten nonconsumable electrode, were cast into ingots. The ingots were forged and subjected to homogenizing annealing in vacuum at 1250 degrees C for 25 hr. Specimens prepared from the ingots were tested for ultimate strength and creep. It was found that the ultimate strength of niobium-tungsten and niobium-titanium alloys increased with increasing tungsten or titanium content up to 10 percent. Results of creep tests showed that alloying with tungsten increased and alloying with vanadium or titanium decreased the creep strength. The effect of alloying elements on creep strength increased with increasing content. TAB

N70-14293# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
MATERIALS RESEARCH AT CHALK RIVER
Oct. 1969 20 p refs
(AECL-3478) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

CONTENTS:

1. FRACTURE OF PRESSURE VESSELS W. J. Langford p 1–3 (See N70-14294 04-32)

2. HIGH RESOLUTION ELECTRON MICROSCOPY F. Brown p 4–7 refs (See N70-14295 04-26)

3. GRAPHITE IN NUCLEAR FUELS J. A. L. Robertson p 8–10 ref (See N70-14296 04-22)

4. FABRICATION OF EXPERIMENTAL TUBING J. S. Nelles p 11–13 (See N70-14297 04-15)

5. DEVELOPMENT OF ZIRCONIUM ALLOYS FOR HIGH TEMPERATURE APPLICATION C. D. Williams p 14–15 (See N70-14298 04-17)

6. THERMAL OXIDATION OF METALS B. Cox p 16–17 (See N70-14299 04-17)

N70-14298# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
DEVELOPMENT OF ZIRCONIUM ALLOYS FOR HIGH TEMPERATURE APPLICATION
C. D. Williams *In its* Mater. Res. at Chalk River Oct. 1969 p 14–15 (See N70-14293 04-17)
Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

Zircaloy and the Zr-2.5% Nb alloy have been successfully developed for use in CANDU reactors up to 350 C. Alloys for higher temperatures are being formulated using the extensive experience in titanium alloy development as well as zirconium alloy work. Experimental melts of promising alloys are evaluated by tensile and creep testing in combination with structural analysis. The combinations of thermal and deformation treatments used in specimen preparation have been chosen principally to represent fabrication processes which are feasible for pressure tube manufacture. Author

N70-14299# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
THERMAL OXIDATION OF METALS
B. Cox *In its* Mater. Res. at Chalk River Oct. 1969 p 16–17 (See N70-14293 04-17)
Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

The oxidation rate of unalloyed zirconium is controlled by the electron flow and not by ionic diffusion through the oxide. For Zircaloy-2 and other zirconium alloys containing intermetallic particles the electronic resistance of the oxide is lowered and ionic diffusion determines the rate, but not in a simple manner. The oxidation of other metals forming thick insulating oxides may also be controlled by the electron current. Author

N70-14306# Air Force Systems Command, Wright-Patterson AFB, Ohio.
CHANGE OF CREEP RATE OF METAL DUE TO THE ADSORPTIVE EFFECT OF A LIQUID METAL MEDIUM
V. I. Nikitin 22 Apr. 1969 12 p refs Transl. into ENGLISH from Izvest. Metally (Russian), no. 3, 1968 p 139–142
(AD-695198; FTD-MT-24-29-69) Avail: CFSTI CSCL 11/6

The effect of adsorptively-active liquid metals on solid (metals) during deformation appears in different forms. One effect of their influence is an increase of the creep rate of solid metals. This effect just as other effects of the easing of plastic deformation (lowering of yield point and coefficient of hardening during deformation at constant speed), is determined by the decrease of the power barrier preventing dislocations on the metal surface. The existence of the barrier is connected with the formation of new step-wise surface at the place of the edge dislocation. Author (TAB)

N70-14324# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL STRAIN HARDENING OF NICKEL-FREE STRUCTURAL STEELS
M. I. Kurmanov et al 26 Mar. 1969 17 p refs Transl. into ENGLISH Sb. Tr. Ukr. Nauchn.-Issled. Inst. Metallov, no. 10, 1964 p 328–340
(AD-695012; FTD-HT-23-1150-68) Avail: CFSTI CSCL 11/6

Thermal strain hardening of nickel-free structural steels was studied, using steel specimens smelted in a 200-KG open induction furnace. The specimens were homogenized for 10 H at 1180 C and reduced to 37 x 37-mm size. Thermal strain hardening was carried out at 850 and 500 C. The mechanical properties, austenite concentration in the specimens, and the size of martensite needles in the latter were determined, and the experimental results tabulated. It was found that thermo-mechanical treatment of specimens at 500 C with 74 percent degree of deformation yielded steel with a strength limit of 275 kg/sq mm. Best results were obtained when the specimens were tempered at 100 C. It is suggested that the observed strengthening effect is due to a decrease in the size of martensite needles in the specimens. TAB

N70-14326# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE FINE CRYSTAL STRUCTURE OF STEEL SUBJECTED TO SHAPING AT A HIGH RATE OF DEFORMATION
V. G. Kononenko et al 25 Mar. 1969 15 p refs Transl. into ENGLISH from Obrabotka Metallov Davleniem v Mashinostr. (USSR), no. 1, 1967 p 9–16
(AD-695320; FTD-HT-23-1202-68) Avail: CFSTI CSCL 11/6

The effect of strain rate on crystal lattice distortion was investigated on specimens of St. 10 and St. 45 carbon steels, and 30KhGSA low-alloy high-strength steel. X-ray diffraction pattern examination and microstress and microhardness measurements showed that impact straining at both 20 and -180 degrees C resulted in greater microstresses and microhardness than those produced with static straining. The effect was more pronounced with straining at low temperatures, e.g., at the maximum rate of straining (150 m/sec) at -180C, the level of microstresses was 50 percent higher than with straining at 20C. An analogous increase in the microhardness indicated that the steel strengthening followed a similar pattern. The increase in strain hardening with increasing strain rate was accompanied by a noticeable increase in lattice distortion without any substantial fragmentation of the blocks. Author (TAB)

N70-14354# Oak Ridge National Lab., Tenn.
TECHNIQUE FOR MEASURING THE DIFFUSIVITY AND SOLUBILITY OF GASES IN METALS WITH APPLICATION TO NITROGEN IN TUNGSTEN
Richard Louis Wagner (M.S. Thesis - Tenn. Univ.) Jul. 1969 45 p refs
(Contract W-7405-eng-26)
(ONRL-TM-2584) Avail: CFSTI

An ultrahigh vacuum technique, suitable for the determination of the solubility, diffusivity, and permeability of gases in metals is described as applied to nitrogen–tungsten systems. The method depends on the measurement of the degassing rate of nitrogen as a function of time from resistivity heated wire specimens, previously equilibrated in nitrogen at 1 to 25 torr, with a mass spectrometer and a known vacuum conductance. The permeation constants calculated from these results agree within a factor of two with

directly measured values reported in the literature. The diffusion constants agree within a factor of three with literature values, although the activation energies for diffusion (35,800 – 62,000) are quite different. The solubility obeys Sievert's law and exhibits a positive activation energy for solution. The concentration rf nitrogen in tungsten at 1 atm pressure according to the solubility constant is 0.4 ppM at 1000 deg C and 9.2 ppM at 2000 deg C. Author (NSA)

N70-14356# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH-TEMPERATURE MATERIALS

E. N. Marmer et al 6 May 1969 264 p refs Transl. into ENGLISH from Vysokotemperaturnye Materialy (Moscow), 1967 p 1 – 215

(AD-696047; FTD-MT-24-270-68) Avail: CFSTI CSCL 11/6

The book summarizes published works and experience of the authors on refractory metals and oxides, graphite and refractory carbides; some specific features in measuring temperatures with the aid of thermocouples and optical pyrometers are discussed. TAB

N70-14363# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

WEAR RESISTANCE OF VAPOR-DEPOSITED COATINGS

F. Sarkisyan 25 Apr. 1969 13 p refs Transl. into ENGLISH from Prom. Armenii (USSR), no. 3-4, 1968 p 71 – 74

(AD-695890; FTD-MT-24-60-69) Avail: CFSTI CSCL 11/6

Vapor condensates of chromium, in spite of comparatively low microhardness as compared to galvanically deposited chromium, are more wear-resistant. Condensed coatings of Cr-Ni-Fe-Co alloy are 1.5 times more wear-resistant than electroplated coatings. Vapor condensed coatings of chromium and Cr-Ni-Fe-Co alloy, in contrast to electrolytically deposited chromium, can be used to restore parts working in a medium of comparatively great temperature stresses. Author (TAB)

N70-14371# Japan Atomic Energy Research Inst., Tokyo.

ANALYSIS OF ZIRCONIUM AND ITS ALLOYS

Jul. 1969 226 p refs In JAPANESE; ENGLISH summary

(JAERI-4050) Avail: CFSTI

This book contains analytical methods for determining Al, B, C, Ca, Cd, Cl, Co, Cr, Cu, Fe, H, Hf, Li, Mg, Mn, Mo, N, Nb, Ni, O, Pb, Si, Sn, Ti, U, and W in zirconium and zircaloy, and for determining Nb and Ta in zirconium alloys. An important subject of the committee was the preparation of standard samples. The preparation and homogeneity tests of the zircaloy samples and of the zirconium-niobium alloy samples are recorded. Comparison data of the analytical results are presented. Author

N70-14378# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

GAS RELEASE BY MOLYBDENUM AT HIGH TEMPERATURES

T. N. Zagorskaya et al 16 Apr. 1969 14 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Izvest. Metally, (Russian), no. 1, 1968 p 221 – 225

(AD-695333; FTD-MT-24-480-68) Avail: CFSTI CSCL 11/6

Interstitial impurities adversely affect the mechanical properties and processability of Mo and W. In this connection, high-temperature vacuum degassing of these metals is of major interest; precise knowledge of the composition and quantity of the gaseous impurities liberated from the specimens at high temperatures is a prerequisite for the proper selection of the degassing regime. All previous studies in this field have, however, been based on apparatus with vacuum systems producing a vacuum not deeper than 10 (to the minus 5th power) torr and contaminating the specimens with the carbon present in the oil vapors of the vapor-oil diffusion pumps employed. The current study, by contrast, is based on the use of the most up-to-date vacuum equipment, oil-less means of evacuation, and the electron-beam method of heating the specimens. Author (TAB)

N70-14377# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EVALUATING THE INFLUENCE OF PLASTIC DEFORMATION TO THE DAMAGE SUSCEPTIBILITY OF MATERIALS FROM THE NATURE OF FATIGUE-STRENGTH CHANGE

V. A. Zhukov et al 3 Feb. 1969 12 p refs Transl. into ENGLISH from Prochnost Metallov Pri Tsiklicheskikh Nagruzkakh Materialy (Moscow), 1967 p 76 – 82

(AD-694797; FTD-HT-23-689-68) Avail: CFSTI CSCL 11/6

The effect of preliminary tensile deformation on the fatigue strength of ferrous and nonferrous materials is examined. Samples were fatigue tested in pure shear at a frequency of 3000 cycles/min. The endurance limit was arbitrarily selected as 5,000,000 cycles. After undergoing plastic deformation in tension, some samples had their surfaces machined off to a depth of 0.2-0.3 mm. Before fatigue testing, all surfaces were polished with a rubber wheel. Microhardness tests along the cross section and near the surface showed no change in hardness after machining. The ratio of endurance limit at any tensile strain to that at zero strain was used to determine the effect of plastic deformation. The fatigue strength of type 35 steel in the normalized and tempered (650C) condition is given as a function of the number of cycles to failure. Author (TAB)

N70-14379# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

NON-DESTRUCTIVE CONTROL OF NON-FERROMAGNETIC METAL SHEETS BY MEANS OF EDDY CURRENTS: INVESTIGATION FOR OPTIMAL CONDITIONS OF THICKNESS AND ELECTRIC CONDUCTIVITY VARIATION DETECTION, VOLUME 2 [CONTROLE NON DESTRUCTIF DES TOLES METALLIQUES NON FERRO-MAGNETIQUES A L'AIDE DES COURANTS DE FOUCAULT: RECHERCHE DES CONDITIONS OPTIMALES DE DETECTION DES VARIATIONS D'EPAISSEUR ET DE CONDUCTIVITE ELECTRIQUE]

A. Philippe Aug. 1969 89 p refs In FRENCH; ENGLISH summary

(EUR-3483F-Vol-2) Avail: CFSTI

The first part of this report concerned the calculation of the complex impedance of a coreless cylindrical probe in the presence of a metal plate. Author

N70-14381# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF HEAT TREATMENT ON THE TEXTURE OF TITANIUM ALLOYS AND CHROMIUM AND NICKEL ELECTROPLATED ON THEM

I. E. Kontrovich et al 30 Jan. 1969 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met. (Ozaudzhikau), v. 9, no. 5, 1966 p 124 – 128

(AD-695222; FTD-HT-23-860-68) Avail: CFSTI CSCL 11/6

The heat treatment of Ti alloy (OT4) results in textures differing from the basic rolling pattern. For electrodeposited Cr and Ni, heat treatment shifts the textural axis from (111) and (112) to (001) extending at all times to the region (110). TAB

N70-14388# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATIONS OF THE PROPERTIES OF Ni-Co-Ti-Al

ALLOYS OF HEAT-RESISTANT, CURRENT-CARRYING SPRINGS

Zh. P. Pastukhova et al. 31 Jan. 1969 29 p refs Transl. into ENGLISH from Tr. Gos. Nauchn.-Issled. i Proektn. Inst. Splavov i Obrabotki Tsvetnykh Metallov (Moscow), no. 26, 1967 p 240–263
(AD-695905; FTD-HT-23-772-68) Avail: CFSTI CSCL 11/6

In a search for heat and oxidation resistant alloys with high electric conductivity suitable for making springs in various electric devices, three series of quaternary nickel-base alloys of the Ni-Co-Ti-Al system, containing respectively 10, 20, or 30% have been investigated. Author (TAB)

N70-14392# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHYSICAL AND MECHANICAL PROPERTIES OF Ti-V-Al ALLOYS

G. P. Kalinin et al. 2 May 1969 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally, no. 4, 1968 p 165–169
(AD-695315; FTD-MT-24-30-69) Avail: CFSTI CSCL 11/6

The most complete data about the Ti-V-Al system are contained in this work. Alloys investigated in this work contained up to 60 percent V and up to 10 percent Al (the remaining is titanium), which corresponds to alpha -, (alpha plus beta) - and beta-phase regions of the phase diagram. Seventy-gram ingots were smelted in an arc electrical furnace with a permanent tungsten electrode in an atmosphere of argon. For uniform alloys every ingot was turned four times and subjected to repeated remelting. A check weighing showed that the weight of the ingots very insignificantly differs from the weight of the initial charge, therefore the chemical composition of the alloys is given with respect to data about the composition of the charge. Author (TAB)

N70-14416# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE DEVELOPMENT OF THE THEORETICAL PRINCIPLES OF THE VOLUMETRIC DEFORMATION OF METALS

Yu. N. Alekseev 3 Apr. 1969 10 p ref Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota, no. 5, 1966 p 32–36
(AD-694832; FTD-HT-23-1280-68) Avail: CFSTI CSCL 11/6

The work presents the basic positions in the calculation of the volumetric deformation processes of metals during pressure treatment. Formulas and illustrations are given for this purpose. TAB

N70-14428# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A METHOD OF INVESTIGATING THE PROCESSES OF CREEP AND STRESS RELAXATION IN METALS AND ALLOYS

A. A. Chizhik 19 May 1969 17 p refs Transl. into ENGLISH from the Russian
(AD-694963; FTD-MT-24-525-68) Avail: CFSTI CSCL 11/6

A new method of testing metals for creep and stress relaxation, which requires no complex equipment and makes such tests possible en masse, was developed. The basis of the method is a specimen possessing low rigidity whose working part is a cylindrical spring of square cross-section. This type of specimen eliminates expensive equipment and substantially increases accuracy in the measurement of creep deformation. The proposed method is the first to permit organization of mass tests of the creep resistivity of boiler pipes of any geometry, including those for steam superheaters, screening equipment, and heat-exchanging apparatus. Author (TAB)

N70-14451# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MICROSTRUCTURAL INVESTIGATION OF PLASTIC FLOW OF NICKEL-TITANIUM ALLOY AT DIFFERENT TEMPERATURES AND STRETCH RATES

V. M. Zinchenko et al. 28 Mar. 1969 20 p refs Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (USSR), no. 1, 1967 p 119–130
(AD-694900; FTD-HT-23-1230-68) Avail: CFSTI CSCL 11/6

The microstructural characteristics of the plastic flow of a nickel-titanium alloy were studied in view of the use of such materials as the basis of many commercial heat resistant alloys. High temperature metallographic methods were used making it possible to observe kinetics of the microstructure changes developing on the sample surface, and in turn making it possible to establish the laws of formation and development of deformations in the material under study. TAB

N70-14452# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRESS CORROSION OF HIGH-STRENGTH STEELS

F. F. Azhogin 31 Jul. 1969 28 p refs Transl. into ENGLISH from the book "Korroziya i Zashchita Metallov" Moscow, State Publ. House of Defense Ind., 1957 p 99–130
(AD-694820; FTD-MT-24-78-69) Avail: CFSTI CSCL 11/6

This work studies the effect of composition of corrosive medium, heat treatment and surface state on the corrosion cracking of high-strength steels. Testing methods are discussed. TAB

N70-14453# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEVELOPMENT OF THE PRODUCTION OF LIGHT ALLOYS

A. F. Belov et al. 21 May 1969 29 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Izv. Metally (USSR), no. 5, 1967 p 85–99
(AD-694839; FTD-MT-24-512-68) Avail: CFSTI CSCL 11/6

The development and the present status of the production of aluminum, magnesium and titanium alloys are reviewed, and current problems in the production technology of these alloys are outlined. One of the important problems in improving the quality of semifinished products from aluminum alloys is to improve the homogeneity of their structure and to eliminate local discontinuities in metal. The problem is being solved by decreasing the content of oxide inclusions and hydrogen and by increasing the metal density by using hydrostatic compression in the first stage of deformation. One of the most promising methods of strengthening aluminum alloys is structural strengthening which consists essentially in producing a nonrecrystallized (polygonized) structure in alloys after heat treatment. The problem of increasing the heat resistance of aluminum alloys is being solved mainly by developing SAP-base alloys, alloys with refractory metals, and aluminum alloy-base composites. Author (TAB)

N70-14460# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTROCHEMICAL AND CORROSION BEHAVIOR OF TITANIUM DURING ITS POLARIZATION BY ALTERNATING CURRENT OF VARIOUS FREQUENCIES

N. D. Tomashov et al. 23 Apr. 1969 23 p refs Transl. into ENGLISH from the book "Korroziya i Zashchita Konstruktsionnykh Splavov" Moscow, Nauka, 1966 p 83–96
(AD-694778; FTD-MT-24-495-68) Avail: CFSTI CSCL 11/6

An investigation of Ti in sulfuric acid and HCl solns. was carried out at a.c. frequencies of 20-2000 cycles/sec. in 10N sulfuric acid and 20-1000 cycles/sec. in 10N HCl solns. By superimposing an a.c. the anodic dissoln. of Ti is intensified, and this phenomenon is accelerated by higher frequencies. For the return of the Ti from the active to the passive condition in 10N sulfuric acid it is necessary to pass the current at the rate of 0.48 x 10 (to the minus 3rd power) coulomb/cm (to the 2nd power) of metal surface which converted into no. of 0 atoms corresponds to 1 monoat. layer. This also indicates that a corresponding

quantity of O was present on the Ti surface. The Ti dissoln. rate in 10N HCl under the action of a.c. of all frequencies was considerably higher than in sulfuric acid of equal concn. This indicates that Cl is the activating agent. TAB

N70-14473# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MEASUREMENT OF FORCE DURING THE PULSE DEFORMATION OF METALS

V. G. Kononenko et al 28 Mar. 1969 14 p refs Transl. into ENGLISH from Obrabotka Metallov Davleniyem v Mashinostr. (Kharkov), no. 1, 1967 p 75 – 81

(AD-695224; FTD-HT-23-120)-68) Avail: CFSTI CSCL 11/6

Ram impact machines were developed for testing materials with impact tension, shear, upsetting, and cutting. The machines make it possible to measure: deformation time, the mean deformation rate, the time-deformation dependences, deformation load, pressure in the combustion chamber of the ram impact machine, and other dynamic stresses appearing in test specimens and in the elements of testing and working units and tools. The article describes the test method and a modernized electron-beam oscillograph of the OK-17M type employed for registration of stresses, pressures and elastic displacements appearing in test specimens and in individual components and parts of machines. Wire resistance-type sensing elements, glued onto specimens being tested or on an intermediate elastic element are used as sensors. The measured signals are photographically recorded on the oscillograph screen. The described apparatus can be recommended for research work in the field of high-speed testing and pressure working of metals, and also for measuring dynamic stresses appearing in machine parts, tools, and aircraft. Author (TAB)

N70-14498# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE FRACTURING OF STEEL AS A PROCESS OF THE COALESCENCE OF MICROCRACKS

V. M. Finkel et al 17 Apr. 1969 13 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izvest. Met. (Russian), no. 2, 1968 p 171 – 175

(AD-695310; FTD-MT-24-479-68) Avail: CFSTI CSCL 11/6

The phenomenology and mechanism of the process of the merging of microcracks during fracture are investigated in 20 x 60 mm specimens of St.3 low carbon sheet steel 0.3 mm thick. The surface of specimens was prepared as a metallographic section and subsequently the specimen was bent several times until appreciable cracks had appeared; these cracks had to be larger than the grain size of this steel. Subsequently the specimens were fractured by means of a falling weight and the process of fracture was observed with the aid of a micro-filming device. The kinograms thus obtained show a discontinuous propagation of fracture in the carbon steel, with microcracks arising ahead of the main crack and with distinct plastic zones around and ahead of the cracks. As the spaces between cracks diminish to minus 2 mm, the crack trajectories deviate from the line of operation of maximum tensile stresses and subsequently the merger of the plastic zones and hence also of the cracks occurs along the line of operation of maximum tangential stresses. Author (TAB)

N70-14499# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE METAL SCIENCE OF HIGH-MELTING METALS AND ALLOYS

E. M. Savitskii et al 28 May 1969 408 p refs Transl. into ENGLISH of the book 'Metallovedenie Tugoplavkikh Metallovi Plavov' Moscow, Izd. Nauka, 1967 p 1 – 323

(AD-696043; FTD-HT-23-1067-68) Avail: CFSTI CSCL 11/6

The book summarizes works of Soviet and Non-Soviet researchers on the structure and properties of refractory metals and alloy. The principal physical properties of refractory metals, such as thermal, electrical and mechanical properties, are discussed. Also discussed are the fundamentals of alloy theory, experimental methods of plotting phase diagrams, and the interaction between refractory metals and other elements of the periodic table. A separate chapter explains aspects of the cold brittleness of refractory metals and methods applied to combat it. Considerable attention is paid to an investigation of the structure and properties of single crystals of refractory metals and alloys. Data on the oxidation of refractory metals are presented, and the possibility of increasing the heat resistance of metals and combining them with other materials is discussed. Author (TAB)

N70-14513# Aluminum Co. of America, Pittsburgh, Pa.

ALUMINUM

J. R. Chapman *In* AEC Abundant Nucl. Energy May 1969 p 137 – 161 refs (See N70-14504 04-22)

Avail: CFSTI

The technology and economics of producing primary aluminum are presented briefly. Operations from mining through fabrication to sheet and plate are described. Investment and operating cost factors are included, chiefly as tables and graphs. Flow charts and photographs illustrate the principal features of the processes involved. Author (NSA)

N70-14514# Magnalith Corp., New York, N.Y.

MAGNESIUM

Sven Fougner *In* AEC Abundant Nucl. Energy May 1969 p 163 180 (See N70-14504 04-22) refs

Avail: CFSTI

Two currently employed electrolytic reduction processes, both based on seawater magnesia, are reviewed and a novel technology is outlined for deriving magnesium from brine magnesium chloride and thereby improving process economics with coproduced chlorine. Typical uses of the metal are described in text and illustrations, and the competitive relation, magnesium vs. aluminum, is illustrated by examples. Author (NSA)

N70-14515# City Coll. of the City of New York.

IRON AND STEEL WITH HYDROGEN

Arthur M. Squires *In* AEC Abundant Nucl. Energy May 1969 p 181 – 196 refs (See N70-14504 04-22)

Avail: CFSTI

Ironmaking processes suitable for providing a reduced-iron product to electric steelmaking furnaces are considered. Suitable processes employing reducing gases produced from natural gas include those that reduce a lump ore in a static or gravitating bed at temperatures above about 1600 F and the H-Iron process, in which finely divided ore is reduced by hydrogen in a fluidized bed operating at about 900 F and 500 psi. Only the latter process is suitable for using hydrogen produced by an advanced technique for electrolyzing water. When such a technique and breeder power reactors become available, a steel industry can be sited economically without regard to the availability of fossil fuels. Author (NSA)

N70-14516# Bureau of Mines, Salt Lake City, Utah. Metallurgy Research Center.

ELECTROWINNING OF METALS

Joe B. Rosenbaum *In* AEC Abundant Nucl. Energy May 1969 p 197 – 201 refs (See N70-14504 04-22)

Avail: CFSTI

Power use in electrowinning some 3 million tons of aluminum in 1966 was about 54 billion kW-hr. Production of steel in electric furnaces used 30 billion kW-hr, ferroalloys used about 14 billion, and elemental phosphorus used about 7 billion. The relation between cost of energy for electrowinning and the selling price of selected

metals is presented to illustrate the incremental benefit of cheaper power. The outlook for uses of electricity in electro-metallurgy is discussed. Author (NSA)

N70-14551# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE RESISTANCE OF HEAT-RESISTANT ALLOYS TO THERMAL FATIGUE AS A FUNCTION OF THERMAL STRESS
R. A. Dulnev 25 Apr. 1969 10 p refs Transl. into ENGLISH from Russian conf.
(AD-695193; FTD-HT-23-1455-68) Avail: CFSTI CSCL 11/6

To study the effects of varying heat stresses on machine parts during starting and when changing operating regimes, investigations were made of heat-resistant EI437B, EI617, EI867, and EP109 alloy specimens under loads, using the Koffin-type setup. The greatest reduction in the number of cycles was observed during the maximum-temperature periods which measured 1.5 min. As the cycle length increased further, the effect became smaller. It is, therefore, possible to assume that the damage occuring during the maximum-temperature period, takes place in the specimen mainly during the first stage of the constant-temperature application. Damage is due to creep and redistribution of stresses which develop during the maximum-temperature period. As a result of the damage, the number of cycles preceding breakdown decreased but the total length of time before breakdown remained little affected. Author (TAB)

N70-14558*# Tyco Labs., Inc., Waltham, Mass.
STUDY OF THE GENERAL MECHANISM OF STRESS CORROSION OF ALUMINUM ALLOYS AND DEVELOPMENT OF TECHNIQUES FOR ITS DETECTION Final Report, 1 Jun. 1968 - 1 Jun. 1969
S. B. Brummer, R. O. Bell, F. H. Cocks, and A. Cordellos Sep. 1969 336 p refs
(Contract NAS8-20297)
(NASA-CR-102409) Avail: CFSTI CSCL 11F

The objectives of this investigation were to examine the mechanism of the stress corrosion cracking (SCC) of Al alloys (phase I), and to study the feasibility of using instrumental methods to detect stress corrosion cracking on fabricated Al alloy parts (phase II). The mechanism of SCC of high strength Al alloys was investigated using electrochemical, mechanical, and electron microscopic techniques. Corrosion and stress corrosion experiments were carried out in 1M NaCl buffered to pH 4.7, usually at 30 C, using the commercial alloys 7075 and 2219 and also relevant pure materials. Correlations were made between susceptibility to SCC and the following properties of the particular alloys: metallurgical condition, mechanical properties (macroscopic and local), corrodibility (macroscopic and local), ambient conditions in the corrodent, and surface treatment. Author

N70-14578# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WORK HARDENING OF 26 Kh2NGSM STEEL DURING PLASTIC DEFORMATION IN THE HARDENED STATE
G. I. Ashmarina et al 25 Apr. 1969 14 p refs Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (USSR), no. 5, 1968 p 80-85
(AD-695891; FTD-MT-24-66-69) Avail: CFSTI CSCL 11/6

The work hardening of 26Kh2NGSM steel during deformation in the martensite state depending upon the degree of reduction and tempering was investigated. It was shown that the effect of work hardening and the character of the change in plasticity and viscosity depend on the method of treatment. The highest complex of properties is obtained during treatment by the method of quenching-tempering at 200 degrees - 20 percent reduction. Deformation of martensite promotes the deceleration of the processes of stress relief during final tempering. The high values of the yield point and of ultimate strength are maintained during heating up to 400 degrees C. With testing during the biaxial state of strain it was also established that treatment by the marforming process improves the properties which are characterized by the structural strength of the investigated steel. On the bases of the obtained results proposals were formulated on the possible structural processes, entering into the formation of the properties of steel during its deformation in the martensite state. Author (TAB)

N70-14597# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE WEARING ACTION OF LIQUID-VAPOR POCKETS
S. P. Kozyrev 23 Jun. 1969 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp., no. 2, 1968 p 63-70
(AD-695940; FTD-MT-24-48-69) Avail: CFSTI CSCL 20/4

The basic problems connected with propagation of elastic vibration in various media are reviewed in popular form. The design of various emitters; the applications of ultrasonic vibration for dispersion, emulsification, coagulation and rectification of liquids, scrubbing of gases and use in metallurgy and metalworking industry are described. Author (TAB)

N70-14598# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME CASTING PROPERTIES OF HIGH-ALLOY NICKEL ALLOY EI765 (Kh70VMYuT)
A. S. Loboda 23 Jun. 1969 9 p refs Transl. into ENGLISH from Russian Conf.
(AD-694794; FTD-MT-24-105-69) Avail: CFSTI CSCL 11/6

The fluidity changes with increasing temp. just as in 30L alloys. The pouring temp. of component pieces is 1460-80 degrees. The addn. of 0.1-0.2 percent Ca or 0.05 percent Ce and 0.10 percent Ba to the ladle decreases the fluidity considerably. The addn. of 0.3 percent Ca and Ce or 0.2 percent Ba increases the fluidity again. The addn. of 0.3-0.7 percent Nb has no effect on the fluidity of the alloy. Free linear shrinking is 2.6 percent. Heating the alloy to 1530 degrees increases the thermal stability twice as much as that of the 30L alloy. Further heating, however, decreases the thermal stability. Thermal processing is practically ineffective on the microstructure of the poured metal. The addn. of Ca, Ce, and Ba has no effect on the microstructure either. Author (TAB)

N70-14601# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE PHASE DIAGRAM FOR THE Mo-Zr-C SYSTEM IN A REGION RICH IN MOLYBDENUM
A. M. Zakharov et al 30 Apr. 1969 15 p ref Transl. into ENGLISH from Akad. Nauk SSSR Izv. Metally (USSR), no. 6, 1967 p 193-200
(AD-694850; FTD-HT-23-1260-68) Avail: CFSTI CSCL 11/6

A series of Mo-Zr-C alloys containing 0-0.55% wt. C, 0-6.0% wt. Zr, and about 0.011% O, 0.008% N, and 0.0006% H impurities, were melted from single crystal molybdenum, 99.94 percent - pure Zr, lamp black and spectrally pure zirconium carbide (ZrC) in a nonconsumable-electrode arc furnace in a helium atmosphere. The alloys were investigated by various methods of physicochemical and phase analyses in the ascast condition and also after vacuum annealing and quenching from temperatures ranging from 1970 to 1250C. On the basis of the results obtained, isotherms were plotted for the solidus surface of molybdenum alpha-solid solution in the ternary Mo-Zr-C system, and also isothermal sections at 1970 and 1250C, and a polythermal Mo-Zr-C section. Author (TAB)

N70-14659*# Revere Copper and Brass, Inc., Brooklyn, N.Y.
ALUMINUM AND ALUMINUM OXIDE IN ZERO GRAVITY

L. F. Mondolfo *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 176–182 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 11F

An experiment is described to test the feasibility of using absence of gravity to mix immiscible materials. The mixing of aluminum oxide into molten aluminum has been chosen, as representative of the dispersing of immiscible solids into liquids. The equipment planned consists of a small self-contained furnace burning a Thermit mixture, which can handle some 100 grs. of metal. A gas operated stirrer will provide the mixing. One of two results is expected: (1) Mixing is successful; and (2) freezing produces separation. In either case, industrial exploitation is to be expected. Author

N70-14660*# TRW Systems, Redondo Beach, Calif.
REDUCED GRAVITY PROCESSING OF HOMOGENIZED IMMISCIBLE METAL ALLOYS
J. L. Reger, M. E. Kirkpatrick, and R. L. Hammel *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 183–194 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 11F

Reduced gravity material experiments to process and prepare unique metal alloy systems from normally immiscible liquid phase melts are described. The effects of low gravity environment on the observed immiscibility limits of two phase liquid combinations are considered. Included are discussions of homogenized alloy processing covering production of materials with unique physical and electrical properties, consideration of basic solidification processes, and the potential application of homogenized alloys in the preparation of composite materials. Potential experiment performance limitations, requirements and interface criteria are identified. These considerations will include both phenomenological materials behavior and the practical experiment software, hardware and astronaut interfaces. Author

N70-14703# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF ALLOYING ON THE MECHANICAL PROPERTIES OF CAST TANTALUM
M. A. Tylkin et al 23 Apr. 1969 18 p refs Transl. into ENGLISH from Probl. Bolshoi Met. i Fiz. Khim. Novykh Splavov (Moscow), 1965 p 241–249
(AD-695911; FTD-MT-24-36-69) Avail: CFSTI CSCL 11/6

The effect of alloying with Ti, Zr, V, Nb, Cr, Mo, W, Re, Co, or Ni on the mechanical properties of cast tantalum have been investigated. The hardness of unalloyed tantalum drops with increasing purity. Alloying, as a rule, increased hardness and strength, but reduced ductility. Cobalt and nickel produce the sharpest increase in hardness; titanium and niobium had practically no effect. The best combination of properties was achieved by alloying with tungsten, molybdenum, or rhenium, which raises the room temperature strength of the alloy while maintaining sufficient ductility. At 1500 and 1800C, the strength of tantalum-tungsten and tantalum-rhenium alloys is 2-3 times higher than that of unalloyed tantalum. The maximum strength of tantalum-niobium alloy is attained at a niobium content of 30-40 percent; in this case, however, the alloy elongation drops to 18-20 percent and the reduction of area to 38-47 percent. Tantalum-niobium alloy has good formability at room temperature regardless of the amount of components. Author (TAB)

N70-14704# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF ALLOYS OF THE Ti-V-Cr-Mo SYSTEM
P. B. Budberg et al 10 Sep. 1969 12 p refs Transl. into ENGLISH from Akad. Nauk. SSSR Izv. Metally (Moscow), no. 6, 1968 p 201–205
(AD-694419; FSTC-HT-23-382-69) Avail: CFSTI CSCL 11/6

Isothermal cross-sections of the tetrahedron of the Ti-V-Cr-Mo system according to the TiCr2-V-Mo profile has been studied at 1300, 1200, 900, and 600C. The TiCr2-V-Mo profile is quasi-ternary in the temperature intervals studied. The change in hardness of these alloys is in complete agreement with their phase structure. Author (TAB)

N70-14705# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Division.
LUBRICANT FOR THE HOT EXTRUSION OF METALS
P. I. Chuyko et al 21 Apr. 1969 4 p Transl. into ENGLISH from Russian Patent no. 208161 (Appl. no. 1107028/23-4, 10 Oct. 1966) 1 p
(AD-694424 ; FTD-HT-23-1372-68) Avail: CFSTI CSCL 11/6

The patent describes a method of using calcium borate as a lubricant in the hot extrusion of metals. TAB

N70-14748# Air Force Systems Command, Wright-Patterson AFB, Ohio.
TENSILE MICROTESTS OF HIGH-MELTING METALS AND ALLOYS AT TEMPERATURES OF UP TO 1600 C IN A VACUUM
B. M. Ovsyannikov et al 26 Mar. 1969 19 p refs Transl. into ENGLISH from Tsentralnyi Nauchno Issledovatelskii Inst. Chernoi Metallurgii (USSR) no. 48, 1967 p 144–151
(AD-695022; FTD-HT-23-1171-68) Avail: CFSTI CSCL 11/6

A modified version of the IRM-02 (MIFI) microtesting machine was developed for mechanical tests of vertically positioned microspecimens. The machine serves to determine the following mechanical characteristics: ultimate strength, yield point, proportional limit, tensile strength, relative elongation, and relative reduction in area. Its principal elements are: (1) table equipped with an electric motor and reducing gear; (2) base, with columns and electric heating furnace; (3) loading assembly; (4) dynamometric mechanism; (5) heater unit; (6) vacuum systems; (7) cooling system; (8) control panel with thermometric and metrological accessories. Maximum loading 1000 kg; maximum required power 2 kva; test time per specimen 30-35 min; dimensions of machine – length 1.5 m, width 0.86 mm, height 1.6 mm. The load applied is automatically recorded with the aid of a slidewire pickup and an EPP-09 type electronic potentiometer. Tests carried out with the aid of this machine demonstrated the reliability and stability of performance of the entire installation. Author (TAB)

N70-14749# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF RADIATION OF METALLIC MATERIALS
L. N. Bystrov et al 5 May 1969 16 p refs Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (USSR), No. 1, 1967 p 17–26
(AD-696045; FTD-HT-23-1240-68) Avail: CFSTI CSCL 11/6

The mechanism of influence of high-energy radiation on mechanical properties of metallic materials is analyzed in view of using the radiative treatment for prescribed variation of properties of metals and alloys. Three possible mechanisms of interaction are discussed: (1) direct interaction of radiational defects with dislocations; (2) radiational stimulation of chemical processes in crystals (dissociation of supersaturated solid solutions, alloy ordering etc.); (3) nuclear alloying. It is noted that the second mechanism is the most promising from the viewpoint of generating stable changes in metals. Author (TAB)

N70-14810# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF MECHANICAL HEAT TREATMENT ON THE CYCLIC STRENGTH OF HEAT-RESISTANT ALLOYS
A. A. Gorbatov et al 12 Mar. 1969 10 p refs Transl. into

ENGLISH from the Russian
(AD-694179; FTD-HT-23-1140-68) Avail: CFSTI CSCL 11/6

The effect of mechanico-thermal treatment (MTT) on the fatigue strength of EI867 and EI437B nickel alloys has been investigated and the optimal conditions of MTT for these alloys have been determined. Specimens of EI867 nickel alloy were annealed at 1220 degrees C for 5 hr, air cooled, and aged at 950 degrees C for 8 hr. Specimens of EI437B nickel alloy were annealed at 1080 degrees C for 8 hr, air cooled and aged at 700 degrees C for 16 hr. The heat-treated specimens were slowly stretched (0.04 mm/min) at 500-900 degrees C up to 0.2-4 percent elongation. After stretching the specimens were held at 500-900 degrees C for 24 hr. So prepared specimens were fatigue tested at 700-900 degrees C under fluctuating loads at 2900 cycles/min.
Author (TAB)

N70-14815# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
MOLTEN SALT BREEDER STUDY: MATERIALS STUDIES Annual Report, 1968 [SALZSCHMELZENBRUETER-STUDIE: MATERIALUNTERSUCHUNGEN, JAHRESBERICHT, 1968]
I. Ali Khan Jul. 1969 80 p refs In GERMAN
(JUEL-608-RW) Avail: CFSTI

High melting point metals and iron alloys of high nickel content were evaluated for their compatibility with liquid sodium coolant and resistance to molten fluoride salts at high temperatures. 16/13 and 18/10 chromium-nickel steels exhibited little corrosion resistance to molten fluoride salts but improved after additions of titanium-magnesium and magnesium inhibitors to the molten salt. Increased uranium tetrafluoride concentrations in molten salt increased also steel corrosion; a niobium layer on the steel surface also improved corrosion resistance of steel below 800 degree C. Cold temperature areas in pure niobium loop walls were also attacked; a niobium-zirconium alloy exhibited better resistance to molten salt corrosion than the pure niobium loop. Fracture free niobium layers of 150 micron were deposited on the steel by galvanometric methods; these layers remained intact up to 1000 degree celsius in an argon atmosphere. Transl. by G.G.

N70-14824# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Nuetronenphysik.
NERNST EFFECT IN SUPERCONDUCTING LEAD AND NIOBIUM [NERNST EFFEKT IN SUPRALEITENDEM BLEI UND NIOB]
Albrecht Seher Jun. 1969 79 p refs In GERMAN
(JUEL-598-FN) Avail: CFSTI

Reported are Nernst effect measurements on superconducting lead films in the intermediate stage and on superconducting niobium foils in the mixed state. Extended measurements on current flow resistance were used to determine the entropy transport characteristics of flow lines. It was found that in a magnetic field of about 350 to 400 Gauss transport entropy was a function of film thickness and reached in films up to 3 micron thickness a maximum of about 60 percent of the calculated value. Critical current and temperature gradient correlation with film thicknesses indicated that most currents are found in the probe surface layer and contribute little to Lorentz force flow lines. Nernst effect and current flow resistance were also measured on superconducting niobium foils as function of a magnetic field at 4.2 degree K. Evaluation of critical current and temperature gradients also seemed to indicate that surface current flow was predominant.
Transl. by G.G.

N70-14837# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MANUFACTURE, PROPERTIES AND APPLICATION OF ZIRCONIUM BASE ALLOYS
K. S. Pridantseva 7 Apr. 1969 22 p refs Transl. into ENGLISH from Tsentral. Nauchno Issled. Inst. Chernoi Met. Sb. Trudov, (Russian), no. 51, 1967 p 139–152
(AD-694926; FTD-MT-24-457-68) Avail: CFSTI CSCL 11/6

An experimental study was done on the wire and sheet production, properties, and applications of zirconium base alloys. Zirconium alloys were melted from an iodide by the consummable arc method under an argon atmosphere into 200-300 g ingots. Sheets were made by hot and cold rolling, using intermediate annealing at 800 degrees C under a vacuum of 1 x 10 to the minus 4th power mm Hg. The scrap percentage was about 15-35 percent, depending on the rolling technique. Wires of 0.8-1.0 mm diameter were drawn by plating with a 2-5 micron coating of copper and using ordinary mill lubricants. Colloidal graphite was far superior to any other lubricant used. The chemical compositions of 10 different alloys were given, along with the coefficient of linear expansion, electrical resistivity, and magnetic susceptibility. Alloys were made with up to 1.1 percent Hf, 7 percent Ti, and 0.1 percent of Al, Be, Si, Mo, V, Sn, Mn, and Re. The properties of technically pure titanium were also given as a comparison. The tensile properties, microhardness, and elastic modulus of the above alloys were presented.
TAB

N70-14843# Air Force Systems Command, Wright-Patterson AFB, Ohio.
MEASUREMENT OF FORCES IN IMPACT DEFORMATION OF METALS
V. G. Kononenko, et al 8 May 1969 14 p refs Transl. into ENGLISH from Obrabotka Metallov Davleniem v Mashinostroenii (USSR) no. 1, 1967 p 75–81
(AD-693826; FTD-HT-23-71-69) Avail: CFSTI CSCL 14/2

The Chair of Aircraft Production at Kharkov Aviation Institute has developed and built a number of ram impact machines for testing materials with impact tension, shear, upsetting, and cutting. The machines make it possible to measure: deformation time, the mean deformation rate, the time-deformation dependences, deformation load, pressure in the combustion chamber of the ram impact machine, and other dynamic stresses appearing in test specimens and in the elements of testing and working units and tools. The article describes the test method and a modernized electronbeam oscillograph of the OK-17M type employed for registration of stresses, pressures and elastic displacements appearing in test specimens and in individual components and parts of machines. Wire resistance-type sensing elements, glued onto specimens being tested or on an intermediate elastic element are used as sensors. The measured signals are photographically recorded on the oscillograph screen. The described apparatus can be recommended for research work in the field of high-speed testing and pressure working of metals, and also for measuring dynamic stresses appearing in machine parts, tools, and aircraft.
Author (TAB)

N70-14851# Watervliet Arsenal, N.Y. Benet R&E Labs.
ANISOTROPY OF FATIGUE CRACK PROPAGATION IN HOT ROLLED BANDED STEEL PLATE
Francis A. Heiser (Ph.D. Thesis - Lehigh Univ.) Oct. 1969 119 p refs
(AD-695656; WVT-6931) Avail: CFSTI CSCL 11/6

The anisotropy of fatigue crack propagation in hot rolled steel plate was studied for three orientations relative to the rolling direction, viz., crack arrester, crack divider and short transverse. By controlling the heat treatment it was possible to modify the banded pearlite-ferrite microstructure to develop the following structures: pearlite-ferrite (homogenized), martensite (tempered)-ferrite (banded) and martensite (tempered)-ferrite (homogenized). These structures exhibited a range of mechanical properties, with the tensile strength varying from 70 to 200 ksi and the yield strength from 50 to 150 ksi. The fatigue crack growth rate data were interpreted in fracture mechanics concepts. The dependence of crack growth rate on stress intensity factor was shown to be sensitive to the microconstituents

present and their orientation relative to the fracture plane and direction. Generally, crack growth rate dependence on stress intensity range increased as the material toughness decreased and when the fibering was oriented parallel to the fracture plane and direction.
Author (TAB)

N70-14870# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF INCLUSIONS AND STRUCTURE OF MELTS OF 08KH20N10G6 STEEL MELTED WITH VARIOUS DEOXIDIZING AGENTS
G. P. Gromova, A. G. Rylnikova, A. A. Smirnova, A. K. Krasnova, and M. I. Vinograd 5 May 1969 22 p refs Transl. into ENGLISH from Tsentri. Nauchn Issled. Inst. Chernoi Met. Sb. Trudov, (Russian), no. 48, 1967 p 51–63
(AD-695918; FTD-HT-23-1049-68) Avail: CFSTI CSCL 11/6

The characteristic features of structure and inclusions of 08Kh20N10G6 Cr-Ni electrode steel were investigated in 10 different melts of this steel, containing different deoxidants, namely, ferrosilicon, calcium, ASK alloy, ferrosilicon plus cerium, calcium plus cerium, ASK alloy plus cerium. Specimens taken from the chilled ingots were subjected to metallographic, electron-microscopic and petrographic examinations. Author (TAB)

N70-14950# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISPERSION HARDENING IN NIOBIUM BASE ALLOYS
E. M. Savitskii et al 21 Apr. 1969 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Metally (USSR) no. 3, 1967 p 152–158
(AD-694776; FTD-MT-24-399-68) Avail: CFSTI CSCL 11/6

By methods of microstructural, electrochemical and X-ray analyses it was shown that base niobium alloys (system Nb-W-Mo-Zr-C), containing zirconium in their composition age at temperatures 900-1100 degrees C with the formation of oxide, nitride and carbide phases. The deformed and annealed states were studied for prolonged use at high temperatures in relation to coagulation and the embrittling effect of oxide and nitride phases.
TAB

N70-14990# Army Foreign Science and Technology Center, Washington, D.C.
INVESTIGATION OF Al-Be ALLOYS WITH Y, La AND Ce ADDITIVES UP TO 33.3 AT PERCENT
O. S. Zarechnyuk et al 9 Sep. 1969 10 p refs Transl. into ENGLISH from Izvestiya Vysshikh Uchebnykh Zavedenii (USSR), v. 12, no. 1, 1969 p 122-125
(AD-694417; FSTC-HT-23-381-69) Avail: CFSTI CSCL 11/6

Various properties of Y- Be- Al, La- Be- Al, and Ce- Be- Al systems were compared. In the region of 0.33.3 at. % (REM) content, all three form single ternary compounds D-phase in La- Be- Al and Ce- Be- Al and D'-phase in the Y- Be- Al system. They differ in that in the Yttrium and Lanthanum systems the compounds (phase D or D') is in equilibrium with Aluminum, and in the Cerium system it is not. The ternary compound which forms in the Y- Be- Al systems is not isostructural with the compounds of La and Ce and contains more Aluminum than they do. It is concluded that the Y- Be- Al and La- Be- Al systems resemble each other and differ from the Ce- Be- Al system in the character of the phase equilibrium, whereas the La- Be- Al and Ce- Be- Al compounds are more closely related in the type of crystalline structure which forms.
Author (TAB)

N70-15007# Oak Ridge National Lab., Tenn.
CONCENTRATION CHANGES IN BINARY METAL-GAS SOLUTIONS IN THE CASE OF SIMULTANEOUS EVAPORATION OF GAS AND METAL. PART 1
Gerhard Hoerz 1969 14 p refs Transl. into ENGLISH from Z. Metallk., (Russian), v. 60, 1969 p 115–120
(ORNL-TR-2170) Avail: CFSTI

Concentration changes in binary metal-gas solutions during simultaneous removal of gas and evaporation of metal are investigated. Cases discussed in which the gas (G) is removed by the evaporation of the metal gas compound (MG) and by the desorption of the gas molecule G2. In both cases the formation and evaporation of MG or G2 are assumed to be the rate-determining step. Conditions are discussed under which the gas concentration in the metal decreases, is constant, or increases. Relations for the dependence of the gas concentration in the metal gas solution on the annealing time are reported and discussed for special cases. For negligible gas uptake and rate constant of metal evaporation to rate constant of gas removal which is not too high it was found that if the gas removed obeys a first order rate law the gas concentration in the metal–gas solution decreases continuously with increasing annealing time without reaching a limit value.
Author (NSA)

N70-15011# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF PRELIMINARY DEFORMATION ON STATIC CRACK AND FATIGUE STRENGTH OF STEEL EI-726
L. V. Balashov et al 11 Apr. 1969 21 p refs Transl. into ENGLISH from Fiz. i Khim. Drabotki Materialov (USSR), no. 3, 1967 p 79–86
(AD-694838; FTD-MT-24-478-68) Avail: CFSTI CSCL 11/6

The effect of extensive (up to 40 percent) plastic deformation by pulling, compression, or torsion at room temperature on the static crack and fatigue strengths of chromium-nickel-tungsten-niobium steel 1Kh14N18V2BR1 was boron additive (steel EI-726) was investigated at elevated temperatures. The steel 1Kh14N18V2BR1 was subjected to standard heat treatment: hardened at 1170 degrees, air-cooled, and tempered at 1750 degrees for 25 hours. Samples were then subjected to plastic deformation at 20 degrees or at 700 degrees. Author (TAB)

N70-15029# Naval Research Lab., Washington, D.C.
CORROSION ANALYSIS OF 304 STAINLESS STEEL WIRE ROPE AND FITTINGS FROM A NOMAD BUOY MOORING SYSTEM AFTER 34 MONTHS CONTINUOUS SERVICE IN THE GULF OF MEXICO
Thomas J. Lennox, Jr. Sep. 1969 22 p refs
(AD-695372; NRL-MR-2045) Avail: CFSTI CSCL 13/10

Samples from a 1250-ft length of 304 stainless steel wire rope and associated stainless steel tube thimbles and stainless steel cable clamps were studied to determine the extent of corrosion after 34-months continuous immersion in the Gulf of Mexico. This 3/4-in.-diam wire rope (6 x 19 Warrington - IWRC 7 x 7) was used in the upper portion of a Nomad buoy mooring system. The performance of this particular buoy design is important because of its possible influence on the national buoy program. Author (TAB)

N70-15032# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center
METAL-MATRIX COMPOSITES
May 1969 133 p Held at the Proc. of the Symp. on Metallurgical Soc., Pittsburgh, 12-13 May 1969
(Contract F33615-69-C-1343)
(AD-695046; DMIC-MEMO-243) Avail: CFSTI CSCL 11/4

The papers in this report were presented at a Symposium jointly sponsored by the Structural Materials and Composite Materials Committees of the Institute of Metals Division, AIME. This meeting, which was held on May 12-13, 1969, is significant in that it reflects the growing maturity of this new materials technology. The sponsorship of the Structural Materials Committee is evidence of the rapidly increasing interest by those concerned with the practical

use of metallic materials in structures. It also marks the initial technical activity of the newly organized Composite Materials Committee, whose primary function will be to insure that future developments of composite materials receive adequate and timely technical exposure in the materials community. The members of the Structural Materials Committee were very pleased to have been able to help this new Committee in its first venture.
Author (TAB)

N70-15043*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STRESS CORROSION CRACKING OF Ti-6-Al-4V TITANIUM ALLOY IN VARIOUS FLUIDS
James G. Williamson 19 Nov. 1969 18 p refs
(NASA-TM-X-53971) Avail: CFSTI CSCL 11F

An investigation of the stress corrosion susceptibility of Ti-6Al-4V alloy in various fluids was initiated because of the recent unexpected failures of this alloy in both nitrogen tetraoxide and absolute methanol. This study has indicated that Ti-6Al-4V alloy is susceptible to stress corrosion cracking in absolute methanol in both the annealed and solution treated and aged (STA) conditions. The threshold value for annealed material appears to be near 50 percent of the yield strength or approximately 70,000 psi, while the value of STA material is somewhat less. Long term exposure tests (two years) indicated that the Ti-6Al-4V alloy is not susceptible to stress corrosion cracking in acetone, Aerozine 50, distilled water, absolute ethanol, Freon PCA, Freon MF, hydraulic oil (MIL-H-5606), absolute isopropanol, monoethyl hydrazine, RP-1 fuel and trichloroethylene.
Author

N70-15087# Southampton Univ. (England). Inst. of Sound and Vibration Research.
HIGH AND LOW STRESS LEVEL FATIGUE FRACTURES IN MILD STEEL Summary Report
Matej Bily and Thomas R. G. Williams Wright-Patterson AFB, Ohio AFML Aug. 1969 22 p refs
(Contract F61052-68-C-0027)
(AD-695067; ISAV-Memo-259; AFML-TR-69-213) Avail: CFSTI CSCL 11/6

Fatigue fractures of mild steel under sinusoidal and random loading conditions have been investigated. The fractures can be divided into two groups: at low stresses the fatigue crack paths are transcrystalline and at high stresses they are both transcrystalline and intercrystalline. The transition occurs over a narrow stress range and is associated with a discontinuity in the S/N curve. This discontinuity involves the onset of yielding at the root of the notched specimens and the yield point in cyclic loading correlates with yielding in monotonic straining.
Author (TAB)

N70-15143 Texas Univ., Austin.
DISLOCATION INTERACTIONS IN FCC METALS DURING CYCLIC STRESSES
Syed Badaruddin Hyder (Ph.D. Thesis) 1968 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-6165

Research is made on the study of dislocation interactions during fatigue to examine the mechanism of fatigue hardening on a microscopic level. To make the results more meaningful, the experiments were conducted on polished metal foils which were fatigued by manually applied bending stresses inside the electron microscope. The dislocation interactions were observed directly during fatigue and analyzed without any further treatment of the metal foils. It is important to study the reactions that are occurring among dislocations which culminate in the formation of tangles and cell structure. This study involved looking for reactions which led to the nucleation of a dislocation tangle alone, after which the dislocation arrangement becomes too complicated for reasonable analysis. Such studies in both aluminum and copper indicate the important role played by dislocation - dislocation interactions in the creation of a tangle.
Dissert. Abstr.

N70-15180 Arizona Univ., Tucson.
TEXTURE AND MECHANICAL ANISOTROPY IN THE COPPER-ZINC SYSTEM
Arthur William Stephens (Ph.D. Thesis) 1968 229 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 69-5701

Texture and its relation to mechanical anisotropy in the alpha region of the copper-zinc alloy system were studied. High-purity copper and copper-zinc alloys were rolled to 96% reduction at ambient temperature. The rolling textures produced in these materials were evaluated by X-ray diffraction techniques and the data were presented in the form of conventional pole figures. The transition in texture from pure-metal to alloy-type was found to be present in the Cu-2.5% Zn alloy and to be essentially complete with the addition of 15% zinc. Further additions of zinc caused no change in texture. It was found that changes in apparent stacking fault energy, resulting from thermal treatment, had no effect on the texture as determined by X-ray diffraction. It was found that long-range ordering in Cu3Au can produce a change in texture.
Dissert. Abstr.

N70-15203# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF METALLURGY: RARE METALS, VOLUME 1
10 Apr. 1969 460 p refs Transl. into ENGLISH of the book "Osnovy Metallurgii. Redkiye Metally" Moscow, Met., v. 4, 1967 1-651
(AD-695878; FTD-MT-24-160-68-Vol-1) Avail: CFSTI CSCL 11/6

The volume describes the theory and actual production of molybdenum, tungsten, vanadium, and cobalt.
TAB

N70-15204*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF METALLURGY: RARE METALS, VOLUME 2
10 Apr. 1969 329 p refs Transl. into ENGLISH of the book "Osnovy Metallurgii. Redkiye Metally" Moscow, Met., v. 4, 1967 p 1-651
(AD-695897; FTD-MT-24-160-68-Vol-2) Avail: CFSTI CSCL 11/6

The volume describes the theory and actual production of niobium, tantalum, zirconium, hafnium, rare earth elements, yttrium and scandium.
TAB

N70-15205# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF METALLURGY: RARE METALS, VOLUME 3
10 Apr. 1969 170 p refs Transl. into ENGLISH of the book "Osnovy Metallurgii. Redkiye Metally" Moscow, Met., v. 4, 1967 p 1-651
(AD-695898; FTD-MT-24-160-68-Vol-3) Avail: CFSTI CSCL 11/6

The volume describes theory and actual production of selenium, tellurium, gallium, indium, thallium, germanium, and rhenium.
TAB

N70-15393* Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
TENSILE PROPERTIES OF IRRADIATED Ti-5 PER CENT Al-2.5 PER CENT Sn ELI AT CRYOGENIC TEMPERATURES
R. P. Shogan Nov. 1968 29 p refs Sponsored in part by NASA
(NASA-CR-107582; WANL-TME-1860) Avail: CFSTI CSCL 11F

Tensile specimens of titanium (5%) aluminum (2.5%) tin ELI (extra low interstitial) alloy were irradiated at the Ground Test

Reactor in test GTR-19 to fluences of 5.6 to 11 times 10 to the 17th n/sq cm (E is greater than 1 MeV). The irradiated temperature was 140 R. Ultimate and yield strengths increased slightly while the notched strength was unaffected. At 140 R the percent elongation of specimens from a forging was significantly, though not seriously, reduced. Sheet specimens showed slight reductions in elongation, while that of the welded sheet specimens increased. About 60% of the radiation damage effect is annealed out at room temperature. Most of this recovery occurs within one hour. Complete annealing occurred after one hour at 1000 R. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-14108# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PLASTIFICATION OF FILM-FORMING POLYMERS

N. Ya. Gribkova 17 Feb. 1969 18 p refs Transl. into ENGLISH from Lakokrasochnye Materialy i Ikh Primenenie (Leningrad), no. 5, 1967 p 87–91

(AD-694924; FTD-HT-23-1108-68) Avail: CFSTI CSCL 11/3

A literature survey on the plastification of film-forming polymers is presented. The survey extends up to the year 1966 and mentions a total of 58 papers. Two different plastification processes are noted, viz., the molecular process and the structure-forming process. The former, known in the literature as the molecular plastification mechanism, involves the formation of a true solution between polymer and plasticizer. The second process involves a supermolecular distribution of plasticizer in the polymer. It is noted that, of the two mechanisms, the molecular plastification mechanism is the more frequently studied and, hence, better known. The effect of different plasticizers on the physical properties of polymers is discussed. It is concluded that the enhanced elasticity of polymeric films, resulting from the addition of plasticizer, is due to the prevention of cross-linkages, i.e., formation of supermolecular structures between the polymer molecules by the plasticizer molecules. Author (TAB)

N70-14124# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF OBTAINING FLAME-RESISTANT POLYACRYLONITRILE FIBER OR FABRIC MADE FROM IT

V. E. Kotina, A. A. Konkin, and R. M. Kosova 13 May 1969 5 p Transl. into ENGLISH from Russian patent no. 138324 28 Mar. 1960 1 p

(AD-693839; FTD-HT-23-127-69) Avail: CFSTI CSCL 11/5

A method is given for obtaining flame-resistant polyacrylonitrile fiber or fabric by thermal treatment (carbonizing) at 200C which is distinguished by the fact that in order to increase the heat resistance while retaining mechanical properties, the polyacrylonitrile fiber or fabric is subjected to stepwise treatment beginning at 200C and then carrying through to 400-475C. Author (TAB)

N70-14169# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF SURFACE-ACTIVE SUBSTANCES ON THE PROPERTIES OF SILICA GEL LUBRICANTS

M. B. Bakaleinikov et al 17 Feb. 1969 11 p refs Transl. into ENGLISH from Neftepererabotka i Neftekhim., Nauchn.-Tekhn. SB. (Moscow), no. 8, 1967 p 19–22

(AD-694847; FTD-HT-23-1121-68) Avail: CFSTI CSCL 11/8

The strength of silica gel lubricants prepared with highly purified oils thickened by hydrophobic and nonhydrophobic silica gel is reduced with an increase in temperature. For the same type of lubricants based on nonhydrophobic SiO2 the change in strength with an increase in the oleic acid concentration has an extremal character with maxima at an oleic acid concentration of 0.5%. The addition of oleic acid lubricants based on hydrophobic silica gel leads to a reduction in the lubricant strength at all temperatures except 120C. At this temperature an extremal dependence with a maximum at an oleic acid concentration of 0.1% is observed. The temperature dependence of the lubricant strength carries an extremal character with a maximum at temperatures ranging from 50 to 120C for lubricants based on low-purity oils, and also for lubricants based on highly purified oils with additions of oleic acid. Author (TAB)

N70-14176# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SYNTHESIS OF NONALKALI GLASS FOR FIBER-GLASS-REINFORCED PLASTIC REINFORCEMENT

N. N. Ermolenko et al 14 Feb. 1969 7 p refs Transl. into ENGLISH from the Russian

(AD-694848; Avail: CFSTI CSCL 11/2

Studies on producing nonalkali fiber glass of sand, kaolin, dolomite, and chalk were performed in an effort to find a substitute for scarce aluminoboron silicate glass. The work was based on a study of glass-formation diagram for the system; silica- alumina - magnesia - lime. Composition designated as 7/10, 10/10, and 7T were found to be most resistant to crystallization and to chemical decomposition. It was determined that type 7T could be readily produced by existing facilities at one eighth the cost of aluminoboron silicate glass and that all three types had satisfactory physical and chemical characteristics. Glass-reinforced plastic made of 7T with bakelite and worked into 3-mm strands had an ultimate tensile strength of 9000-12,000 kg/sq cm2 and modulus of elasticity of 400,000--500,000 kg/sq cm2. Tests on corrosion resistance of fiber glass of 7T proved it equal to that of aluminoboron silicate fiber glass. TAB

N70-14191# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CREEP OF FLEXIBLE FIBERS MADE FOR ORIENTED GLASS-REINFORCED PLASTIC UNDER THE ACTION OF UNIFORMLY DISTRIBUTED LOADING

A. A. Nikishin 2 Apr. 1969 9 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Inst. Khim. Fiz. (USSR), 1967 p 229–233

(AD-694808; FTD-HT-23-1287-68) Avail: CFSTI CSCL 11/2

A theoretical study was done on the creep of flexible fibers made from oriented glass reinforced plastic fibers under the influence of an equilibrium load distribution. A schematic diagram showed a uniform load distribution across a bent fiber, held rigidly at both ends. The deflection was assumed to be a function of distance from the center (x) and of time (t). Based on the assumption, a differential equation was given for the deflection in terms of nondimensional coordinates. A coordinate system was established for given boundary conditions. The deformation of the fiber was composed of elastic and viscoelastic components. The Maxwell equation was given for the case of isothermal creep with a single term for the spectrum of relaxation times. The equations were solved to obtain the stress, deformation, and deflection for different times. These values were given as functions of the logarithm of time for various values of the Maxwell parameters. Author (TAB)

N70-14201# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HEAT CONDUCTIVITY OF PURE OXIDE CERAMICS

I. G. Duderov et al 3 Apr. 1969 18 p refs Transl. into ENGLISH

from the Russian
(AD-694833; FTD-HT-23-1285-68) Avail: CFSTI CSCL 11/2

The values of lamda (heat conductivity) for dense specimens of ceramics made from Al2O3, MgO, and BeO, measured by the methods of stationary and regular heat regimes, differ within the limits of experimental error. The lamda of specimens with similar density depends on the character of their structure, which in turn is caused both by the method of their manufacture and by the heat treatment during annealing and their service. The values of lamda obtained in our investigation for dense ceramics of pure oxides at low temperatures (400-600C) turned out to be significantly smaller than the values given in many foreign sources. Author (TAB)

N70-14202# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF HEAT TREATMENT ON THE CHANGE IN MECHANICAL PROPERTIES OF LAVSAN FIBERS
Yu. F. Morin 3 Apr. 1969 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tekhnol. Tekstil'n. Prom. (Ivanovo), no. 1, 1967 p 30–34
(AD-695327; FTD-HT-23-1203-68) Avail: CFSTI CSCL 11/5

The optimum temperature for stabilization of Lavsan fiber should be considered to be 160-180 degrees C with a duration of treatment of 4-5 minutes; for combined fibers (Lavsan and viscose fiber) the optimum parameters are 150-160 degrees C and 10 minutes. These regimes provided improved strength and elongation, low shrinkage, and low collapsibility of the yarn. Thermofixation of Lavsan fibers, now conducted at 120-150 degrees C at the factory, should be studied further, since the given temperature is located in the zone of the temperature of unstable state of the polymer. Author (TAB)

N70-14205# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHEMICAL FIBERS WITH SPECIAL CHARACTERISTICS
A. D. Virnik, L. S. Calbraikh, and R. M. Livshits 3 Feb. 1969 20 p refs Transl. into ENGLISH from Vesesoyuznoe Khim. Obshchestvo Zh., (Russian), v. 7, no. 6, 1966 p 657–664
(AD-694767; FTD-HT-23-349-68) Avail: CFSTI CSCL 11/5

A review is given of special purpose chemical fibers covers chemical fibers having antibacterial and antimildew properties, flame resistant fibers, fibers and textiles having complex properties and semiconductor properties. The review covers new methods of preparation, toxic and hygienic requirements, and treatment of fibrous materials to render them special properties. The review contains 131 references, most of which are from western sources. Author (TAB)

N70-14247# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROCEDURE FOR DETERMINATION OF CREEP CHARACTERISTICS OF ORIENTED GLASS-FIBER-REINFORCED PLASTICS AT ROOM TEMPERATURE AND ABOVE
D. V. Zambakhidze 3 Feb. 1969 12 p refs Transl. into ENGLISH from Fiziko Khimiya i Mekhanika Orient; Rovannykh Stekloplastikov (Moscow), 1967 p 224–229
(AD-695392; FTD-HT-23-779-68) Avail: CFSTI CSCL 11/9

Creep characteristics of SVAM glass reinforced plastics were studied at different temperatures and stresses. Data were correlated with parameters from the Rabinovich equation which was based on the generalized Maxwell equation. This relation was given for the case of uniaxial tension under isothermal conditions. The parameters in the equation depended on the properties of the glass fibers and binder, and on the direction of loading relative to the axis of elastic symmetry. TAB

N70-14271# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PREPARATION OF B-MODIFICATION SILICON CARBIDE ALLOYED WITH VARIOUS IMPURITIES
N. K. Prokofeva et al 3 Feb. 1969 12 p refs Transl. into ENGLISH from the Russian
(AD-695388; FTD-HT-23-690-68) Avail: CFSTI CSCL 11/2

The beta-modification of silicon carbide can be obtained by any of the following methods: (1) synthesis from silicon and carbon (graphite) at 1400-1500 degrees C, which yields beta-SiC in the form of a dark powder of non-stoichiometric composition; (2) crystallization from melts of silicon with certain metals, a process based on the substantial temperature variation of the solubility of silicon carbide in fused metals; beta-SiC is obtained in this case in the form of very small plates and needles; (3) thermal decomposition or reduction of compounds containing silicon and carbon on a surface heated to 1400-2200 degrees C. The report reviews, analyzes, and evaluates these preparation methods. TAB

N70-14273# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE DYNAMIC PROPERTIES OF ORIENTED GLASS-FIBER REINFORCED PLASTICS UNDER COMPRESSION
E. N. Kvasnikov et al 9 May 1969 8 p refs Transl. into ENGLISH from the Russian
(AD-695394; FTD-HT-23-694-68) Avail: CFSTI CSCL 11/4

A study was done on the dynamic compressive properties of glass reinforced plastics, with an epoxy phenol resin and an ED-5 resin binder. The epoxy-phenol material had layers of glass cloth aligned longitudinally and transversely in a ratio 1 to 1; the epoxy resin had a 1 to 5 ratio. Fracture elongation and modulus of elasticity were given as functions of the logarithm of deformation rate for the (1 to 1) material aligned at 0, 22.5, and 45 degrees to the fiber direction. The tensor equations of Ashkenazi were used to relate the strength properties at a given load to the axial orientation and the axis of elastic symmetry. Author (TAB)

N70-14306*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
CORROSION CONTROL AND TREATMENT MANUAL
W. E. Clautice and M. G. Olsen 30 Sep. 1969 45 p Supersedes TM-584
(NASA-TM-X-64017; TM-584; TM-584A) Avail: CFSTI CSCL 11C

Corrosion control procedures at Kennedy Space Center are specified. Preventive maintenance is discussed along with types of corrosion and their causes. Typical corrosion removal and treatment methods are given as well as corrosion protection techniques for specific equipment parts. J.A.M.

N70-14329# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE EFFECT OF TEMPERATURE ON THE MECHANICAL PROPERTIES OF HIGH-STRENGTH GLASS-REINFORCED PLASTICS
V. S. Gumenyuk et al 3 Apr. 1969 10 p ref Transl. into ENGLISH from Termoprochnost Materialov i Konstrukt. Elementov (Kiev), no. 4, 1967 p 155–159
(AD-695323; FTD-HT-23-1461-68) Avail: CFSTI CSCL 11/4

The results from a study of the mechanical properties of certain reinforced plastics are presented. The study was confined to oriented glass plastics and glass plastics in conditions of elevated temperatures (293--573K). Graphs are presented showing: (1) the variation of the relative tensile strength of the glass plastics as a function of temperature; (2) the variation of the tensile modulus of elasticity with temperature; (3) the variation of the relative compressive strength with temperature; and (4) the variation

of the relative impact strength with temperature. It was found that the strength characteristics in compression and the impact strength are more temperature dependent than the tensile characteristics. Compression strength becomes stable at about 373K, and tensile strength becomes stable at around 423K. TAB

N70-14333# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
THE 3200 ANGSTROM PHOSPHOR Quarterly Report, 1 Apr. – 30 Jun. 1969
Jon W. Ogland, Edward C. Malarkey, and Michael R. Natale Sep. 1969 34 p
(Contract DAAB07-68-C-0392)
(AD-694558; QR-4; ECOM-0392-4) Avail: CFSTI CSCL 11/7

The objective of the research was to lead to the production of a cathodoluminescent phosphor which emits with high efficiency in the spectral region around 3200 A. This phosphor is to be incorporated into very high resolution cathode-ray tubes with fiber optic faceplates for data recording on UV sensitive, dry-process film. Most of the effort during this period went into phosphor synthesis and preliminary evaluation, and a large number of experimental samples was prepared. Preparation and processing of zinc orthosilicate doped with titanium dioxide was completed. UV luminescent $BaSiO_3$:Tl and Ba_2SiO_4:Tl were synthesized and shown to luminesce with reasonable efficiencies at low excitation densities but to lose efficiency rapidly with increasing current densities. They were therefore judged to be unsatisfactory materials. $BaSi_2O_5$ could not be successfully doped with thallium. $BaZnSi_4O_{10}$:Pb was investigated further and the optimum firing temperature was determined. Experiments were begun on $SrCaZnSi_2O_7$:Pb. These latter two materials emit at 3100 and 3350 A, respectively, and continue to look quite promising. Changes were made in the experimental apparatus for measuring phosphor efficiencies and maintenance in order to provide greater protection to the operator from stray X-radiation, to allow operation with less attention, and to prevent interference with the tests by X-ray solarization of the faceplates. Author (TAB)

N70-14337# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW LIQUID COOLANT-LUBRICANTS
M. I. Klushin 30 Jan. 1969 11 p refs Transl. into ENGLISH from Mashinostroitel (Moscow), no. 11, 1967 p 23–24
(AD-695317; FTD-HT-23-829-68) Avail: CFSTI CSCL 11/8

The newest developments in domestic and foreign production of cutting fluids are reviewed. Total production of self-emulsifying oils is cited. Recent developments include sulfonate-based self-emulsifying oils for difficult to handle metals and for aluminum and magnesium alloys. Cutting fluids are being produced abroad in the following categories: oils for preparation of emulsions without additives; oils with sulfur, chlorine, or phosphorus; oils containing molybdenum disulfide, solutions based on nitrates or other corrosion inhibitors; chemical fluids with wetting additives; etc. Author (TAB)

N70-14342# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
EFFECT OF SPACE ENVIRONMENT ON MATERIALS, FIRST EDITION
P. C. van der Waal 4 Jul. 1968 40 p refs
(RV-22) Avail: CFSTI

In the introduction outgassing in general, its origin and its problems are discussed. Experiments are described where adhesives for metal bonding and fiberglass reinforced plastics are exposed to a thermal vacuum environment. Some of the adhesives show a loss of strength of more than 10% during an exposure of 20 days. Weight loss curves obtained from the plastics give more information about the behaviour of these materials. Author

N70-14345*# Rensselaer Polytechnic Inst., Troy, N.Y.
[MATERIALS RESEARCH PROGRAM] Semiannual Progress Report, 1 Mar. – 31 Aug. 1969
Sep. 1969 72 p refs
(Grant NGL-33-018-003)
(NASA-CR-107406) Avail: CFSTI CSCL 11D

Progress is reported on studies of the structural characterization and synthesis of materials with emphasis on linear aliphatic polyesters. Two areas of solid state reactions and phase transformations of significant practical application are precipitation from solid solution and the martensite transformation in steels. Studies of mechanical properties and strengthening mechanisms include ionic defects and electronic properties of transition metal oxides, squeeze flow of non-Newtonian fluids, solution properties of polymers, mechanical properties of crystalline and amorphous polymers, polymer rheology, and composite materials. Experimental programs on the electronic and physical properties of materials emphasizes measurement of the thermal conductivity of carefully characterized polyethylene samples as a function of crystallinity. Corrosion of composite alloys, including boron reinforced aluminum, and studies of bio-galvanic batteries for medical devices are reported. R.B.

N70-14361# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF SLIP RATE ON THE EFFECTIVE CONTACT AREA AND FRICTION FORCE OF HIGHLY ELASTIC MATERIALS
G. M. Bartenev et al 30 Jan. 1969 9 p refs Transl. into ENGLISH from Mekhan. Polimerov (USSR), no. 2, 1967 p 309–311
(AD-695230; FTD-HT-23-756-68) Avail: CFSTI CSCL 11/10

An investigation is made of the dependence of the friction force and the effective contact area of synthetic rubbers on the slip rate, by means of measurements based on optical instrumentation. For small and large slip rates, the effective contact area was studied while the friction force was related to the rate in accordance with the molecular kinetic theory of friction. Author (TAB)

N70-14365# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROCHEMICAL METHOD OF INVESTIGATING STRESSES AT THE BOUNDARY OF A GLASS-METAL SOLDERED JOINT
N. K. Derteu et al 5 May 1969 8 p Transl. into ENGLISH from Vses. Simpozium po Prob. Methody Izmereniya Teplovogo Rasshireniya Stekol i Ispol'zuyemykh dlya Spayev so Steklami Metallov, 1st. (Moscow), 1967 p 98–100
(AD-695930; FTD-MT-24-22-69) Avail: CFSTI CSCL 13/5

Experiments were made using optically homogeneous calcium-sodium glass. Thermal expansion curves were obtained experimentally using a Type DKV dilatometer. It was found that the distance between the electrodes has very little effect on the electromotive force. There is, however, a more complicated relationship between the electromotive force and the form of the electrodes. The results indicate that the residual stresses have an effect on the concentration gradients in the layer at the electrode. Author (TAB)

N70-14374# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION AND FRICTION PROPERTIES OF TEFLONS AT LOW TEMPERATURES
K. D. Kharitonova 30 Apr. 1969 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 8, 1968 p 78–83
(AD-695894; FTD-MT-24-113-69) Avail: CFSTI CSCL 11/9

A review is made of low temperature research on the friction

properties and uses of ftoroplast materials (similar to teflon) in which it is generally concluded that their antifriction properties make their use feasible for friction parts operating at cryogenic temperatures. Author (TAB)

N70-14389# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POWDER LUBRICANT BASED ON MOLYBDENUM DISULFIDE

S. V. Grekov 17 Apr. 1969 5 p Transl. into ENGLISH from Russian Patent No. 210310 (23 Nov. 1966) 1 p

(AD-694815; FTD-HT-23-1369-68) Avail: CFSTI CSCL 11/8

This patent introduces a powder-like lubricant of molybdenum disulfide for machining of a cutting tool. To improve the cutting properties of the tool and increase its life, an addition of 15-25 percent sulfur to the powder lubricant is recommended. TAB

N70-14391# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME CHARACTERISTICS OF THE PROTECTIVE EFFECT OF PETROLEUM SOLUBLE CORROSION INHIBITORS FOR IRON IN THE ELECTROLYTE-HYDROCARBON TWO-PHASE SYSTEM

A. A. Gonik 24 Jul. 1969 10 p refs Transl. into ENGLISH from the book "Nauchno. Tekhicheskogo Soveshchaniya po Zashchite c Korrozil Oborudovaniya Neftyanykh i Gazovykh Skvazhin" Baku, Izd AN Azerb. SSR, 1964 p 69–80

(AD-694781; FTD-MT-24-20-69) Avail: CFSTI CSCL 13/8

The report concerns certain peculiarities of the protective action of oil-soluble hydrogen-sulfide corrosion inhibitors in the system of hydrocarbon-aqueous acid condensate of oil field gas pipes. Author (TAB)

N70-14412# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A NEW FLUID LUBRICANT-COOLANT

V. A. Lelyuk 12 Dec. 1968 15 p Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no. 1, 1967 p 132–138

(AD-694828; FTD-HT-23-1039-68) Avail: CFSTI CSCL 11/8

Tests were carried out for the purpose of determining the wear resistance of dies, and checks were made of the basic parameters of manufactured threads with the use of different fluid lubricant-coolants. As a result of the experiments and investigations it has been established that the use of used mineral oils for the indicated purposes improves the wear resistance of the cutting tool and lowers the cost of the technological operations. Author (TAB)

N70-14424# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRESSED STATE AND MECHANICAL PROPERTIES OF COMPOSITE MATERIALS

A. I. Somov et al 7 Apr. 1969 19 p refs Transl. into ENGLISH from Russian conf.

(AD-694840; FTD-MT-24-518-68) Avail: CFSTI CSCL 11/4

This brief review of the stressed state and mechanical properties of reinforced composite materials deals with previously published data. The topics discussed are: (1) stress field generated in the composite material as a result of an applied external load: Youngs modulus; shape and size of inclusions; orientation of inclusion; and deformation of matrix; (2) behavior characteristics of fibrillar composition under an applied mechanical load: influence of the ratio of elastic moduli of components on the limiting strength of composite materials; concentration dependence of strength limit; influence of fiber length on the mechanical properties of composite materials; and heat resistance of composite materials. The discussions are illustrated with appropriate equations and diagrams taken from the literature. It is concluded that it is relatively easy to design composite materials with given mechanical properties. TAB

N70-14456# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF PRELIMINARY PERIODIC LOADINGS ON THE STATIC STRENGTH OF REINFORCED PLASTICS

B. P. Kishkin 30 Jan. 1969 9 p refs Transl. into ENGLISH from Moscow Univ. Herald (Moscow), Ser. 1, Math., Mech., no. 1, 1967 p 68–70

(AD-695391; FTD-HT-23-760-68) Avail: CFSTI CSCL 11/9

Specimens were subjected to the preliminary action of periodic loadings of different duration at stresses which exceed the fatigue limit of the material and are known from ordinary fatigue experiments. The specimens were then under a nonuniform stressed state (bending). After the preliminary loading, the specimen was made to fail statically in plane cantilever bending. As a result, the experimental dependence of the static bending strength on the number of preliminary periodic loadings was obtained. Author (TAB)

N70-14458# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPECIFIC TENACITY DIAGRAMS OF FIBER-REINFORCED MATERIALS

V. S. Ivanova et al 7 Apr. 1969 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (USSR), no. 5, 1967 p 202–206

(AD-695350; FTD-HT-23-1356-68) Avail: CFSTI CSCL 11/4

Fiber-reinforced materials with a unidirectional continuous structure of the fiber consist, as a rule, of high-strength rigid fibers spaced parallelwise uniformly apart in a less rigid and less strong metal matrix and running in a direction parallel to the direction of application of the principal (tensile or compressive) load. In this connection, depending on the relationship between the density and strength properties of the fiber and the matrix, five standard diagrams of the dependence of specific tenacity of the fiber-reinforced material on the volumetric proportion of the fiber are plotted. Considering the difference in elasticity moduli and tensile strength between the fiber and the matrix, it may be stated that fracture of the composite (i.e. fiber-reinforced) material occurs during elastoplastic deformation of either the matrix alone or both the matrix and the fibers. Author (TAB)

N70-14462*# North Carolina State Univ., Raleigh. Dept. of Materials Engineering.

DEVELOPMENT OF HIGH TEMPERATURE MATERIALS FOR SOLID PROPELLANT ROCKET NOZZLE APPLICATIONS Quarterly Progress Report, 1 Jul.—30 Sep. 1969

Charles R. Manning, Jr. and Lynn D. Lineback 1 Oct. 1969 17 p (Grant NGR-34-002-108)

(NASA-CR-107-354; QPR-1) Avail: CFSTI CSCL 11D

Preliminary work is described in the development of a refractory metal and/or graphite composite with a ceramic base having resistance to mechanical and chemical erosion and thermal shock. The composite must demonstrate these properties in the rocket nozzle throat area where the environmental stresses are most severe. Tasks completed include: the acquisition of information on equipment and supplies; the design and construction of custom equipment, and installation; a literature survey on the proposed composites; and, the establishment of standard tests and other procedures for composite and input material evaluation. M.H.E

N70-14470# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF SUPERMOLECULAR STRUCTURES ON THE

CONTACT STRENGTH OF POLYCAPROAMIDE
V. A. Belyi et al 25 Apr. 1969 14 p refs Transl. into ENGLISH from Akad. Nauk BSSR, Vestsi. Ser. Fiz.-Tekhn Nauk (Minsk), no. 4, 1967 p 67–72
(AD-695314; FTD-MT-24-503-68) Avail: CFSTI CSCL 11/9

The nature of the supermolecular structures has an essential influence on the contact strength of polymers. Formation of larger nonuniform supermolecular structures leads to an increase of the temperature of self-heating of the sample and to a considerable drop in the contact fatigue strength of the polymer. The self-heating of samples under the influence of cyclical contact stresses, besides lowering the contact strength, leads to a change of the actual character of failure of polymer samples - to heat distortion instead of fatigue crumbling. The introduction of artificial nuclei of structure formation promotes grinding and regulating the supermolecular structures of the polymer, which leads to a reduction of its temperature of self-heating, an increase of fatigue strength under contact cyclical loads and permits a significant increase of the load ability of machine parts from polymer materials. Author (TAB)

N70-14476# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GRAPHITIZED MATERIALS
V. P. Sosedov et al 7 Apr. 1969 17 p Transl. into ENGLISH from Khim. Tverd. Topl. (Moscow), no. 2, 1968 p 91–98
(AD-695030; FTD-MT-24-482-68) Avail: CFSTI CSCL 11/7

The development of the Soviet industry of graphitized materials and of the present state-of-the-art is reviewed. The important technical properties of the materials, the production, the availability of raw materials and the modern trend in the R and D are discussed. Combinations of graphitized materials with other elements, such as silicon, boron, some metals, and with synthetic resins are mentioned. The level of the production of graphitized materials is indicative of the industrial potential of country: the Soviet industry of these materials has reached the world level now. The history of this development is told briefly in the post-war decades. Author (TAB)

N70-14485*# TRW Systems Group, Redondo Beach, Calif.
PROPULSION BEAM DIVERGENCE EFFECTS Quarterly Technical Report
David F. Hall 15 Nov. 1969 29 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952350)
(NASA-CR-107431; QTR-3) Avail: CFSTI CSCL 11C

The second phase of a program to develop understanding of and tolerance-level criteria for the deleterious effects of electrostatic rocket exhaust impinging on typical classes of spacecraft surfaces was continued. This phase included fabrication of necessary experimental fixtures and exploratory experiments. The current status of fixture design, fabrication, and testing is reported along with experimental and analytical results obtained during the quarter. Sputtered accelerator grid material is an important thruster effluent to spacecraft surfaces, but is negligible in the experimental configuration. Atomic Hg beams did not significantly affect the absorptivity or emissivity of ten typical spacecraft coatings under conditions where at most one monolayer of Hg could be adsorbed. Very high fluxes and large doses of 3 Kev Hg(+) produced marked increases in absorptivity of white paints and rocket test vehicle samples, but not of black paints, Al, Au, and glasses. Emissivities of all samples remained relatively constant. Addition of up to 10% Ag to soft solder apparently does not improve its resistance to Hg attack. Ultimate tensile strength of pure Ag samples is not sensitive to surface coatings of Hg, even following four weeks of reaction time. Author

N70-14490# Battelle Memorial Inst., Columbus, Ohio. Radiation Effects Information Center.
THE EFFECT OF RADIATION ON ELECTRICAL INSULATING MATERIALS
C. L. Henks and D. J. Hamman 16 Jun. 1969 60 p refs
(AD-695440; RECI-48) Avail: CFSTI CSCL 11/7

The report compiles and summarizes the information available in the Radiation Effects Information Centers technical files on the effects of steady-state radiation on electrical insulating materials. The insulating materials are classified as organic or inorganic with separate sections on bulk type specimens (film, sheet, etc.), wire and cable insulation, encapsulating compounds, and connectors and terminals. It is the intent of the report to provide information for ballpark or broad estimates of the effect of radiation on various insulating materials and is meant to be used as a guide in the early design stages. Author (TAB)

N70-14492# Air Force Systems Command, Wright-Patterson AFB, Ohio.
ZIRCONIUM AND NIOBIUM CARBIDE COATINGS ON NIOBIUM, TANTALUM, MOLYBDENUM, AND TUNGSTEN
A. L. Burykina 5 May 1969 12 p refs Transl. into ENGLISH from Seminar po Zashchitnye Pokrytiyan (Leningrad) 1968 p 74–81
(AD-694180; FTD-HT-23-21-69) Avail: CFSTI CSCL 11/3

Several methods of obtaining ZrC and NbC coatings on refractory metals were investigated. The method of obtaining ZrC and NbC coatings, involving deposition of a Zr or Nb layer on a Mo, Nb, or W sutstrate with diffusion impregnation from a solid phase using NH(subscript 4)Cl activation agent and subsequent carburizing at 1300-1700 degrees C for 0.5-5 hr., was found to be unsatisfactory because the diffusion impregnation of Nb, Mo, and W substrates proceeded very slowly, and led to the formation of solid solutions of the metals on the substrate surfaces. This made it almost impossible to obtain sufficiently thick layers of pure Nb or Zr on the surface of Mo, Nb and W substrates. Satisfactory Nb coating on Mo and W substrates were obtained by vapor deposition with an electron beam unit. Dense, strongly adhering niobium coatings with a porosity of less than 5 percent and a microhardness almost equal to that of pure Nb, were obtained in 2 hr on substrates at 500-600 degrees C. Attempts to obtain Zr coatings by the same method were unsuccessful. In obtaining ZrC and NbC coatings by vacuum sintering of degassed Nb, Ta, Mo and W specimens coated with a mixture of bentonite with carbide powder, satisfactory NbC coatings were obtained on Ta; in all other cases the reaction between the carbide powdar and substrate resulted in the formation of intermediate phases. TAB

N70-14503# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROSPECTS FOR THE DEVELOPMENT OF A SYNTHETIC LUBRICANT FOR ANTIFRICTION BEARINGS
I. G. Tsurkan et al 30 Jan. 1969 33 p refs Transl. into ENGLISH from Tr. Vses. Nauchn.-Issled. Insti. Zheleznodorozhnogo. Transp. (USSR), no. 335, 1967 p 30–57
(AD-695913; FTD-HT-23-904-68) Avail: CFSTI CSCL 11/8

Recent work conducted on synthetic lubricants for use in railroad rolling stock is reviewed in a discussion of the following topics: Criteria for characterization of lubricants; Sodium-calcium lubricants; Lithium lubricants; Lithium-lead lubricants; and Investigation on synthetic lubricants. TAB

N70-14508# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF FIBER MISALIGNMENT ON ELASTICITY MODULUS IN EXTENSION OF UNIDIRECTIONAL GLASS-REINFORCED PLASTICS
Yu. M. Tarnopolskii et al 26 Mar. 1969 15 p refs Transl. into ENGLISH from Mekh. Polimerov (USSR), no. 2, 1967 p 243–249
(AD-695348; FTD-HT-23-1183-68) Avail: CFSTI CSCL 11/4

On the basis of the theory of laminated reinforced media with random original irregularities the effect of fiber misalignment

on the elasticity modulus during the extension of unidirectional glass-reinforced plastics has been studied. It has been shown experimentally that comparatively low technological fiber misalignments can be the cause of a considerable change of the elasticity modulus. A model is proposed for determining the effect of fiber misalignment on Youngs modulus; experiments on specimens with set regular fiber misalignment revealed good coincidance with theory. On the series-manufactured material AG-4S the effect of the preliminary strain of the fibers on the elasticity modulus was studied and the magnitude of optimum stretching was established. Author (TAB)

N70-14570*# Westinghouse Research Labs., Pittsburgh, Pa. Ceramics and Glasses Dept.
DEVELOPMENT AND EVALUATION OF CONTROLLED VISCOSITY COATINGS FOR SUPERALLOYS
R. B. Grekila, J. W. Chapman, and D. M. Mattox 31 Aug. 1969 118 p
(Contract NAS3-10486)
(NASA-CR-72520) Avail: CFSTI CSCL 11C

The feasibility of developing glass based protective coatings for superalloys, TD-Nickel, IN-100 and WI-52, was demonstrated. The ability of the coatings to protect superalloys from oxidation was investigated by exposures of coated discs to a temperature of 1149 C at velocities up to 20,000 rev/min and by exposures to thermally cycled combustion products at velocities from 0 to 400 ft/sec. Three types of coatings (glass, crystallized glass, and two phase admixtures) were developed and evaluated. The ability of the coatings to successfully recover from impact by limited viscous flow and subsequent rehealing was determined. One promising coating was developed for IN-100 for use at 1038 C but not at 1149 C. Other coating substrate combinations were suitable for less stringent environments. Author

N70-14613# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OBTAINING HIGH-QUALITY QUARTZ GLASS FROM SYNTHETIC SILICA
I. P. Ogloblina et al 10 Dec. 1968 12 p refs Transl. into ENGLISH from Tr. Vses. Nauch.-Issled. Inst. Khim. Reaktivov Osobo Chist. Khim. Veshchestv (Moscow), no. 29, 1966 p 361–368
(AD-694391; FTD-HT-23-1047-68) Avail: CFSTI CSCL 11/2

The effects of the purity and microstructure of synthetic silica on the quality of quartz glass was studied to define the significance of these factors in producing material for the optical and semiconductor industries. Commercial pure silica and especially pure silica obtained by hydrolysis of silicon tetrachloride were vacuum fused under identical conditions. Both feedstocks gave acceptable glasses of only slightly different content in metallic impurities, probably because of contamination by the melting apparatus. Silica prepared from ethyl silicate was pretreated at 700 or 500C, heated 2 hrs at 700, 900, 1100, 1300, or 1460, or 1460C, and vitrified under identical conditions. Changes in apparent and actual density, specific surface, and porosity of silica and the transparency and bubble content of the produced glasses were measured. Author (TAB)

N70-14617# Pennsylvania State Univ., University Park. Materials Research Lab.
MATERIALS PREPARATION AND CHARACTERIZATION Annual Technical Progress Report, 1 Jul. 1968–30 Jun. 1969
Aug. 1969 143 p refs
(Contract DA-49-083-OSA-3140)
(AD-694556) Avail: CFSTI CSCL 20/12

The document reports the overall research activities of the Materials Research Laboratory of The Pennsylvania State University and the individual activities of the faculty affiliated with it. The survey covers the following: Preparation of materials; including synthesis, thermodynamics, equilibria, kinetics, and crystal growth of inorganic materials; Characterization of materials, which encompasses only those studies which provide, directly, information on the chemical composition or the atomic structure of the phases; Properties of materials, which includes the work on the elastic, magnetic, electrical and optical properties of solids; The glass program, which represents a horizontal cut across the other groupings. A final section on Science Information Dissemination describes the varied and extensive activities of the Laboratory in interacting with the scientific and general public from the level of short courses to that of public policy. Author (TAB)

N70-14621# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROLYTIC DEPOSITION OF SILVER AND GOLD COATINGS WITH INCREASED HARDNESS AND WEAR RESISTANCE
S. Ya. Grilikhes et al 15 Apr. 1969 18 p refs Transl. into ENGLISH from Tr. Vsesoyuznoe Soveshch. po Elektr. Kontaktam i Kontaktnym Materialam, 4th (Moscow), 1967 p 487–499
(AD-694927; FTD-MT-24-516-68) Avail: CFSTI CSCL 13/8

Increased microhardness and wear resistance of electroplated Ag were obtained by deposition from cyanide electrolytes contg. addns. of Ni, Pd, Co, Te, or Sb; the increased microhardness was retained for extended periods only for the Ag-Pd and Ag-Sb coatings. Increased microhardness and wear resistance of electroplated Au were obtained by deposition from cyanide electrolytes contg. addns. of Sb, Cu, or Ag. The increase microhardness of the Au-Cu and Au-Ag coatings was retained for extended periods. The Au-Cu alloy was characterized by a somewhat reduced resistance to corrosion. The switching resistance of the electrolytic alloys was greater than for the pure metals and increased with increase in the content of the alloying components, esp. for low voltages; the difference in the resistances decreased with increased voltage. The aging of the electroplated coating was accompanied by a decrease in the microhardness. Aging was characteristic of the pure electrolytic deposited metals as well as of their alloys and was related to a decrease in the residual stresses. Author (TAB)

N70-14622*# Battelle Memorial Inst., Columbus, Ohio.
PERFECTION OF MATERIALS TECHNOLOGY FOR PRODUCING IMPROVED GUNN-EFFECT DEVICES Interim Scientific Report
R. D. Baxter, J. F. Miller, H. L. Leonard, and A. C. Beer 15 Dec. 1969 26 p refs
(Contract NAS12-632)
(NASA-CR-86277; ISR-2) Avail: CFSTI CSCL 11C

Chemical vapor deposition of GaAs and the preparation of Ga(x)In(1-x)Sb ingots are discussed. Deposition with a Ga/AsCl3 reagent scheme demonstrated the importance of adequate control of the gallium source temperature and the AsCl3/H2 ratio in obtaining high mobility, low carrier concentration GaAs. By programming the Ga or AsCl3 bubbler temperatures during growth, layers of controlled concentration gradients or p-n junctions may be produced without the use of an external dopant source. Zone leveling and solute diffusion methods were used in the preparation of Ga(x)In(1-x)Sb ingots, where x ranged from 0.4 to 0.5. Bulk specimens of the alloy showed microwave oscillations at reduced threshold voltage. The solute diffusion method produced superior specimens and is recommended for future crystal growth experiments. J.M.C.

N70-14627# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF ULTRASONIC VIBRATIONS ON THE EFFECTIVENESS OF LUBRICANTS DURING FREE COMPRESSION OF ALUMINUM
V. P. Severdenko et al 27 Aug. 1969 8 p refs Transl. into ENGLISH from Akad. Nauk. Belorussk. SSR, Vesti, Ser. Fiz.

Tekhnichnykh Navuk (Minsk), no. 2, 1968 p 103–105
(AD-696051; FTD-MT-24-143-69) Avail: CFSTI CSCL 11/8

The influence of applied ultrasonic vibrations on the effectiveness of different lubricants during free compression of A000 aluminum specimens (9 mm in diameter, 4.5 mm high), was investigated. Five different lubricants were studied: machine oil SU; lard; machine oil SU, 35 percent, plus graphite 60 percent, plus CC1(subscript 4), 5 percent; paraffin wax; and paraffin wax, 80 percent plus oleic acid, 20 percent. The experiments were carried out on a 5-ton testing machine using an UZG-10M ultrasonic generator and two PMS-15A magnetostriction transducers. Prior to compression, the specimens were annealed in vacuum at 400C for 2.5 hours, washed in acetone, and kept immersed in the corresponding lubricant for 48 hours. The effectiveness of the lubricants in the presence of ultrasonic vibrations was calculated from the expression formula where K (subscript 1) is the specific applied pressure during compression of specimens without the use of lubricant or ultrasonic vibrations; K(subscript 2) - with lubricant, but without ultrasonic vibrations; K(subscript 3) - without lubricant, but in the presence of ultrasonic vibrations; and K(subscript 4) - with lubricant and ultrasonic vibrations. In all cases, the use of applied ultrasonic vibration increased the effectiveness of the lubricant, with the best results produced on lubricants 2, 3, and 5.
TAB

N70-14647# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-STRENGTH ORIENTED FIBERGLASSES, VOLUME 1
G. D. Andreevskaya 11 Apr. 1969 207 p refs Transl. into ENGLISH of the book "Volume 1. Vysokoprochnye Orientirovannye Stekloplastiki" Moscow, 1966 p 1 152
(AD-695922; FTD-HT-23-621-68-Vol-1) Avail: CFSTI CSCL 11/9

The book generalizes the results of experimental and theoretical studies on the preparation of high-strength oriented glass-reinforced plastics. Chapters 1 and 2 discuss the structure and properties of glass and certain other fibers, and of linear and cross-linked polymeric binders.
Author (TAB)

N70-14648# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-STRENGTH ORIENTED FIBERGLASSES, VOLUME 2
G. D. Andreevskaya 11 Apr. 1969 288 p refs Transl. into ENGLISH of the book "Volume 2. Vysokoprochnye Orientirovannye Stekloplastiki" Moscow, 1966 p 153–370
(AD-695950; FTD-HT-23-621-68-Vol-2) Avail: CFSTI CSCL 11/9

Contents: Adhesion phenomena at the fiber-polymer interface and factors determining adhesive strength; Structural peculiarities and physico-mechanical properties of nonwoven oriented fiberglasses.
TAB

N70-14696# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRENGTH OF GLASS-REINFORCED PLASTICS
F. I. Selitskii 8 May 1969 13 p refs Transl. into ENGLISH from Vses. Zaochn. Politekhn. Inst., Sb. Statei (Moscow), no. 34, 1966 p 115–123
(AD-693827; FTD-HT-23-91-69) Avail: CFSTI CSCL 11/4

A theoretical solution of the problem of strength in glass-reinforced plastics is derived. The ultimate tensile strength values are distributed in the yarn according to the normal distribution law. Exact equations for the load distribution between and along the fibers are derived. The distance from the fiber defect to the place at which the ruptured fiber carries the same load as the integral fiber is represented by several fiber diams. in the usual glass cloth laminates, where the fiber distance is up to 1 fiber diam. An expression for the ultimate normal and tangential stresses carried by the resin near the fiber defect was derived.
Author (TAB)

N70-14700# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GLASS FIBER REINFORCING MATERIALS
E. I. Badalova 14 Feb. 1969 6 p Transl. into ENGLISH from Russian conf.
(AD-694423; FTD-HT-23-1135-68) Avail: CFSTI CSCL 11/4

The selection of a rational type of fiber glass reinforcing material is extremely important, since it determines the quality of the reinforcement, its cost, and the overall economy of the entire production process. For the manufacture of tape to be used in reinforcing concrete pipes it is not advisable to utilize twisted threads, since the process of manufacturing such thread is extremely laborious. The Scientific Research Institute of Glass Fibers and The Scientific Research Institute of Plastics have developed an economical process for obtaining tape (LOS) from primary glass threads and have recommended this technology for introduction into industry.
TAB

N70-14745# Air Force Systems Command, Wright-Patterson AFB, Ohio.
POISSON COEFFICIENT OF POLYMER MATERIALS AS A FUNCTION OF THE STRESS STRAIN STATE
S. K. Abramov et al 5 May 1969 9 p refs Transl. into ENGLISH from Inst. Inzhenerov Zheleznodorozhnogo Transporta, Rostov-on-Don No. 69, 1967 p 30–34
(AD-693816; FTD-HT-23-68-69) Avail: CFSTI CSCL 11/9

Computations are made of the effect of stress in the physical nonlinearity of a material and in a shear stress which brings about considerable changes in the initial shape of the body, on the Poisson rates of polymer materials. It is pointed out that physical nonlinearity in polymer materials substantially affects the Poisson ratio. Under large deformation, the Poisson ratio is a function of deformation. A formula is derived for the experimental determination of the Poisson ratio under large deformations.
TAB

N70-14803# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE ELASTIC PROPERTIES OF ORIENTED FIBER GLASS BY IMPULSE ACOUSTICAL METHOD
E. N. Kvasnikov et al 10 Sep. 1969 10 p refs Transl. into ENGLISH from Russian publ. "Fiziko-Khimiya i Mekhanika Orientirovannykh" Moscow, Nauka, 1967 p 172–177
(AD-696053; FTD-MT-24-168-69) Avail: CFSTI CSCL 11/2

The impulse acoustical method was used to determine the elastic properties of SVAM oriented glass reinforced plastics. Formulas were given for Youngs modulus, shear modulus, and Poissons ratio. These constants were related to the density of the material and the speed of elastic wave propagation in the material. An equation was given for the speed of elastic wave propagation in any direction as a function of the angle and speed of propagation relative to the fiber direction. Experimental values of the elastic constants were obtained in three SVAM materials having an epoxy phenol resin binder, densities ranging from 2.01 to 2.08 g/cm (superscript 3), glass fiber contents ranging from 72 to 78 wt percent, and ratios of longitudinal to transverse fibers of 1 to 1 ratio and 1 to 5 ratio. A schematic diagram showed the experimental arrangement of ultrasonic generator, receiver, and sample. The speed of elastic wave propagation was measured in samples at angles of 0, 15, 30, 45, 60, 75, and 90 degrees to the fiber direction. Mechanical testing was done to determine values of the elastic constants for comparison with the impulse acoustical method. Experimental results were given for the modulus of elasticity as determined by static and dynamic method.
Author (TAB)

N70-14831*# APCO, Accessory Products Co., Whittier, Calif.
FLIGHT AND EXPERIMENTAL EXPULSION BLADDERS FOR MARINER 69 Final Report
John Repar 17 Jul. 1969 40 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951939; APCO Proj. 764400)

(NASA-CR-107435) Avail: CFSTI CSCL 11J

The procedures which were employed in the preparation of hydrazine expulsion bladders for Mariner 69 are described. These were prepared from a butyl rubber compound. A matched aluminum mold with soluble aluminum cores was employed. The process resulted in seamless one-piece bladders. A compounding study for improving the compatibility and permeability of ethylene propylene copolymer and terpolymers with hydrazine was conducted. It was shown that the choice of inert fillers, such as hydrated silica and clay, caused much less hydrazine decomposition than the employment of carbon black. Some of the permeation data were also extremely low. Experimental bladders were produced from one of the compounds which was selected as having the best balance of properties for hydrazine service. Both molding and core dissolution with Compound 10 presented more difficult problems than were encountered with the butyl. Author

N70-14917# Army Foreign Science and Technology Center, Washington, D.C.

SOLID DIELECTRICS: THIN FILMS OF HIGH-MOLECULAR WEIGHT COMPOUNDS: ELECTRICAL TEST METHODS

24 Jun. 1969 24 p Transl. into ENGLISH from RUSSIAN document

(AD-694410; FSTC-HT-23-773-68) Avail: CFSTI CSCL 11/7

The document establishes standards for the testing of high-molecular weight thin films. Specifications are provided for determining the specific resistance, dielectric loss-angle tangent and dielectric strengths of films 0.03 mm and less in thickness. Schematic diagrams are furnished for the specific testing devices authorized. TAB

N70-15028# Brown Univ., Providence, R.I. Div. of Applied Mathematics.

THE PRODUCTION OF TENSILE SHOCK WAVES IN STRETCHED NATURAL RUBBER

H. Kolsky Oct. 1969 8 p refs

(Contract DA-31-124-ARO(D)-358)

(AD-695702; AROD-5606-8-E; TR-14) Avail: CFSTI CSCL 20/11

Experiments are described in which large tensile pulses are propagated along stretched rubber bands. It is shown that if the pulse is sufficiently large in amplitude it develops a tensile shock front as it progresses along the band. Author (TAB)

N70-15119# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRENGTH PROPERTIES OF ZIRCONIUM DIOXIDE REFRACTORIES BASED ON A GRANULAR MASS AT TEMPERATURE UP TO 2500 K

A. A. Grebenyuk et al 20 May 1968 14 p refs Transl. into ENGLISH from Tr. Akad. Nauk Lit. SSR, Ser. B, Fiz-Mat., Khim, Geol. i Tekhn. Nauki (Vilna), no. 1, 1967 p 185–193

(AD-693820; FTD-HT-23-11-69) Avail: CFSTI CSCL 11/2

The influence of the monoclinic phase on the strength of zirconium oxide was tested in a special high-temperature unit. It was shown that under room temperature conditions, the increase in the content of monoclinic phase impaired the strength characteristics of refractories. This phenomenon is caused by the structure of samples in which the monoclinic phase is characterized by a great number of cracks whose size and density increase with the monoclinic phase. At high temperatures the increase in the monoclinic phase has a positive influence on the strength characteristics of the material, caused by decreasing the amount of CaO in the material and a corresponding increase in refractoriness. An increase in the strength of the material was observed at temperatures above 2300 degrees K. Author (TAB)

N70-15153*# Avco Corp., Lowell, Mass. Applied Technology Div.

DEFORMATION PROCESSES IN FORGING CERAMICS Progress Report, 19 Jun. – 19 Sep. 1969

R. M. Cannon and W. H. Rhodes 19 Sep. 1969 30 p refs

(Contract NASw-1914)

(NASA-CR-107563; PR-1) Avail: CFSTI CSCL 11B

The investigation of the deformation processes involved in forging of polycrystalline oxide ceramics is given. A combination of mechanical testing and forging are planned. An extensive review of the literature on the deformation and high temperature fracture of the refractory oxides was made; this suggested that initial efforts be directed toward forging of fine grained Al2O3 and on MgO at high temperatures. Initial mechanical test results on Al2O3 revealed more extensive strain hardening than had been anticipated, a strong Bauschinger effect and a suggestion of a yield effect. The implications of these results are discussed with regard to grain boundary sliding and dislocation mechanisms. Author

N70-15165# Watervliet Arsenal, N.Y. Benet R and E Labs.

COMPUTER SIMULATION OF FIBER MATRIX COMPOSITES

Victor H. Montuori Jul. 1969 46 p refs

(AD-695621; WVT-6930) Avail: CFSTI CSCL 11/4

The report describes the mathematics and computerization techniques for uniformly distributing cylindrical fibers in a predetermined volume, and then calculating the thermal conductivity of the composite. Author (TAB)

N70-15175# National Research Council of Canada, Ottawa (Ontario).

MOISTURE INVESTIGATIONS IN CONNECTION WITH PAINTS ON EXTERNAL RENDERINGS [FEUCHTIGKEITSTECHNISCHE UNTERSUCHUNGEN IM ZUSAMMENHANG MIT ANSTRICHEN AUF AUSSENPUTZEN]

H. Kuenzel Sep. 1969 38 p Transl. into ENGLISH from Zement-Kalk-Gips (Wiesbaden), v. 1, 1966 p 17–29

(NRC-TT-1374) Avail: CFSTI

The permeability properties of a number of commercial emulsion paints were determined along with the effects of two paints on the moisture absorption and emission conditions on rendered test walls under natural weather stresses. Moisture content and distribution in the external wall of two test houses, coated with three different emulsion paints and calcimine, were ascertained. Hardness of external renderings was also investigated. Continuous visual observations were made of the changes occuring in the external walls of the experimental houses. Emulsion paint test results show that: (1) The water vapor diffusion resistance factor of commercial emulsions is in the range of 500 to 6,000 microns. (2) Closed paint films of emulsion paints have a relatively high water-repellent action. (3) Emulsion paints hinder the hardening of pure white lime renderings. (4) An accumulation of moisture may occur in the external walls of residential buildings during winter. J.A.M.

N70-15177# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE COMPOSITION OF THE BLACK CHROME ELECTROLYTIC DEPOSIT

D. P. Zosimovich et al 14 Nov. 1968 6 p refs Transl. into ENGLISH from Ukr. Khim. Zh. (Kiev), v. 33, no. 2, 1967 p 200–201

(AD-694785; FTD-HT-23-620-68) Avail: CFSTI CSCL 11/3

It is shown that the chromium content in the black chrome deposit increases with increasing fluoride-ion content in the electrolyte. The hypothesis is advanced that the additional phase in the deposits represents a compound of intermediate reduction of hexavalent chromium, perhaps oxides of variable composition. Author (TAB)

N70-15214*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
PROGRESS IN THE CREATION OF COMPOSITE MATERIALS FROM OXIDES AND METALS [DOSTIZHENIYA V OBLASTI SOZDANIYA KOMBINIROVANNYKH MATERIALOV NA OSNOVE OKISLOV I METALLOV]
P. P. Budnikov et al Washington NASA Dec. 1969 19 p refs Transl. into ENGLISH from Zh. Vses. Khim. Obshch. (USSR), v. 12, no. 2, 1968 p 122–129
(Contract NASw-1692)
(NASA-TT-F-12654) Avail: CFSTI CSCL 11D

A general discussion is presented of cermet materials, their structures and properties, factors affecting those properties, the technological problems of creating cermets, and the ways in which cermets are used in contemporary technology. Author

N70-15223*# Los Alamos Scientific Lab., New Mex.
CMF-13 RESEARCH ON CARBON AND GRAPHITE Progress Summary Report, 1 Aug.–31 Oct. 1969
Morton C. Smith 18 Dec. 1969 33 p refs Supported in part by NASA
(Contract W-7405-eng-36)
(NASA-CR-107567; LA-4333-MS; PSR-11) Avail: CFSTI CSCL 11G

Carbon and graphite are being investigated as engineering materials, to improve the raw materials and processes used in their manufacture, and to learn how to produce them with consistent, predictable, useful combinations of properties. The approach taken is microstructural, based on study and characterization of natural, commercial, and experimental carbons and graphites by such techniques as X-ray diffraction, electron and optical microscopy, and porosimetry. Physical and mechanical properties are measured as functions of formulation, treatment, and environmental variables, and correlations are sought among properties and structures. Raw materials and manufacturing techniques are investigated, improved, and varied systematically in an effort to create specific internal structures believed to be responsible for desirable combinations of properties. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-14127*# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
METHODS OF SOLUTION OF THE INTEGRAL EQUATION FOR THE FOUCAULT TEST Final Report, 1 Jul.–30 Sep. 1969
B. E. Gatewood Sep. 1969 44 p refs
(Grant NGR-36-008-131)
(NASA-CR-86877; FR-1) Avail: CFSTI CSCL 12A

The linear integral equation is solved by collocation, interation, Fourier series, power series, and an inversion integral for the solid mirror. The collocation and inversion integral solutions appear to be the best and these are used to solve the linear equation of the mirror with a central hole. Numerical integration of the nonlinear equation is made for selected surface deviations to show that results start to change from the linear solution at a surface deviation of 0.015 wavelength. Several possible procedures for calibrating and scaling the input data for the integral equation are described. Author

N70-14158# Catholic Univ. Of America, Washington, D.C. Statistical Lab.
ANALYTICAL PROBABILITY THEORY Final Report
E. Lukacs Aug. 1969 6 p refs
(Grant AF-AFOSR-437-65)
(AD-695096; AFOSR-69-2507TR) Avail: CFSTI CSCL 12/1

Research results under the grant have been summarized in fifteen research articles, six of which have been published and the other nine of which have been submitted for publication. The research results are in the general area of analytic probability theory, but also include work on stochastic convergence, multivariate analysis, stochastic processes, positive definite functions and information theory. TAB

N70-14173# Manchester Univ. (England). Statistical Lab.
PROJECTIVE UNITARY ANTIUNITARY REPRESENTATIONS ON LOCALLY COMPACT GROUPS
K. R. Parthasarathy Aug. 1969 41 p refs
(RR-12/KRP/2) Avail: CFSTI

A systematic theory of continuous representations of a group of symmetries is studied in the quotient group PUA(H) which represents the projective unitary antiunitary group of a separable Hilbert space. Mackey's results on transitive imprimitivity systems are extended to PUA representations and, from the extension, all the positive mass representations of the extended Poincare group are derived. Basic properties of unitary and antiunitary oprators, and the projective unitary antiunitary group are described, followed by proof of a PUA group topology and Borel structure. M.H.E.

N70-14231# Air Force System Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ESTIMATING THE COMPLEXITY OF ALGORITHMS FOR THE CONSTRUCTION OF MINIMAL DISJUNCTIVE NORMAL FORMS OF THE FUNCTIONS OF THE ALGEBRA OF LOGIC
Yu. I. Zhuravlev 3 Feb. 1969 43 p refs Transl. into ENGLISH from Diskretnyi Analiz (Russian), no. 2, 1964 p 4177
(AD-694769; FTD-HT-23-708-68) Avail: CFSTI CSCL 12/1

A definition was formulated in previous papers of a local information computing algorithm, and a study was made of the basic properties of such algorithms. The purpose of the present paper is to introduce the concept of calculability into the class of local algorithms, and to study the calculability of predicates which arise in the solution of problems involved in the construction of minimal disjunctive normal forms for functions of the algebra of logic. Author (TAB)

N70-14269*# Arizona State Univ., Tempe. Engineering Research Center.
ON DETERMINING A DISTRIBUTION FUNCTION KNOWN ONLY BY ITS MOMENT AND/OR MOMENT GENERATING FUNCTION
Thomas W. Hill, Jr. (Ph.D. Thesis) Jun. 1969 183 p refs
(Contract NAS12-2035)
(NASA-CR-86280) Avail: CFSTI CSCL 12A

A procedure for obtaining a probability density function from moment generating functions or moments was developed. Solutions were obtained by integrating and extending theories on the reduced problem of moments and the generalized frequency curves, and by a numerical technique for inverting the Laplace transform of the unknown probability density function. A finite sequence of moments and a cumulative distribution function were determined from a reduced problem of moments. Necessary and sufficient conditions for a unimodal solution were calculated. Two theorems for testing unimodality and the useful properties of moment general functions are discussed. Three series transformations were developed, Gram-Charlier type A, Laguerre, and Gram-Charlier type B. Recommendations are given for future research in distribution function determination. J.A.M.

N70-14301# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
A CHI-SQUARE STATISTIC WITH RANDOM CELL BOUNDARIES
David S. Moore Oct. 1969 22 p refs *Its* Mimeograph Ser. No. 206
(Contracts Nonr-1100(26); F 33615-69-C-1244)
(AD-696072) Avail: CFSTI CSCL 12/1

Given a family F(x1 theta) of sufficiently smooth distributions in k-dimensional space depending on an m-dimensional parameter theta, estimate theta by an asymptotically efficient estimator theta prime. Define a chi-square statistic on random cells whose boundaries depend on theta prime. The asymptotic distribution of such statistics is obtained, generalizing work of A. R. Roy for k=1. The limiting distribution depends on theta in general, but is independent of theta for location and location-scale families. Moreover, the distribution approaches chi square (M-m-1) as the number of cells M approaches infinity. A table of upper critical points is given for several values of M for the case where F(x1 theta) is univariate normal. This should be useful in testing goodness of fit to the normal family. Author (TAB)

N70-14303# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
ONE-SIDED APPROXIMATIONS BY LINEAR COMBINATIONS OF FUNCTIONS
George Marsaglia Sep. 1969 18 p refs Presented at Lancaster Symp. on Approximation Theory, Lancaster, Engl., Jul. 1969 *Its* Mathematical Note No. 623
(AD-695796; D1-82-0913) Avail: CFSTI CSCL 12/1

The paper discusses how to approximate a function g(x) from one side by a linear combination of functions f sub 1 (x), ... f sub n (x) so as to minimize the area between the two. It discusses the problem as one of finding the point where a moving hyperplane last touches a convex set and an approximate procedure based on linear programming methods. It gives details of an algorithm for solving the problem, examples, and applications to Monte Carlo Theory--generating random variables in a computer. Author (TAB)

N70-14304# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
A SINGLE SERVER QUEUE IN DISCRETE TIME
Stella C. Dafermos (Cornell Univ.) and Marcel F. Neuts Oct. 1969 29 p refs *Its* Mimeograph Ser. no. 209
(Contracts Nonr-1100(26); FH-11-6913)
(AD-696074) Avail: CFSTI CSCL 12/2

In a number of queueing problems it is worthwhile to treat time as a discrete variable; both for conceptual and for computational reasons. The paper contains a basic example of a single server queue in discrete time. The time dependent behavior of the queue is analyzed in terms of a bivariate Markov chain. In a lengthy introduction potential applications and computational advantages of this model are discussed. In the final section of the paper the M/G/1 model with group arrivals appears as a limiting case of the present model. Author (TAB)

N70-14328# Midwest Research Inst., Kansas City, Mo. Analysis and Applied Mathematics Section.
RECENT DEVELOPMENTS IN RECURSIVE COMPUTATION
Jet Wimp Wright-Patterson AFB, Ohio ARL Jul. 1969 34 p refs
(Contract F33615-69-C-1564)
(AD-695053; ARL-69-0104) Avail: CFSTI CSCL 12/1

In this report, we give a discussion of the Miller algorithm and other related methods which are used to generate sequences satisfying linear difference equations. The work is partly expository, but there are a number of new results. Author (TAB)

N70-14348*# Texas A&M Univ., College Station. Inst. of Statistics.
TIME SERIES ANALYSIS WITH MISSING DATA Semiannual Status Report, 1 Jun. – 30 Nov. 1969
W. B. Smith 30 Nov. 1969 6 p refs
(Grant NGR-44-001-097)
(NASA-CR-107352) Avail: CFSTI CSCL 12A

A technique for estimating the parameters of a multivariate normal distribution from data vectors, some of which have missing elements is being extended to estimate the covariance function of a weakly stationary time series when the missing observations occur randomly. The spectral density function associated with the parent stochastic process may then be estimated enabling an inference to be made on this parent process. Research is continuing in the following fashion: (1) The procedure is being extended to more general cases and problems. (2) Other forms of stochastic processes are being considered; mainly the use of stochastic processes in compartmental analysis. Author

N70-14378# Sheffield Univ. (England). Dept. of Probability and Statistics.
ROBUST BAYESIAN INFERENCE FOR THE HYPERGEOMETRIC PARAMETER
J. B. Garner Apr. 1969 35 p refs
(RR-61/JBG-8) JBG-8) Avail: CFSTI

Multinomial methods are adapted to give more robust Bayesian inference procedures for the hypergeometric and multivariate hypergeometric distributions. Bayes factor testing procedures and point and interval estimation methods are given. Author

N70-14455# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
A QUEUE SUBJECT TO EXTRANEOUS PHASE CHANGES
Marcel F. Neuts Sep. 1969 69 p refs *Its* Mimeo. Ser. No. 207
(Contract Nonr-1100(26))
(AD-696073) Avail: CFSTI CSCL 12/2

The queueing model discussed here is a generalization of a model of an M/M/1 queue, modified as follows. The queue alternates between two phases I and II. In phase I, the arrival and service rates are lambda 1 and mu 1, whereas in phase II they are lambda 2 and mu 2. The successive lengths of time during which the queue is in phases I and II are independent negative-exponential random variables with parameters s1 and s2 respectively. The paper discusses the following partial generalization of this model. Consider a single server queue, governed by an extraneous phase process. This phase process is assumed to be an irreducible, m-state Markov chain in continuous time, with only stable states. TAB

N70-14483*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
LONG PERIOD PERTURBATIONS IN THE ELEMENTS OF ARTIFICIAL SATELLITES DUE TO HIGH ORDER ZONAL HARMONICS
David Fisher Nov. 1969 27 p refs
(NASA-TM-X-63770; X-550-69-477) Avail: CFSTI CSCL 12A

General formulas for the long period perturbations in the elements of artificial satellites due to high order zonal harmonics are presented. The formulas derived here are based on a more general determining function than Brouwer's determining function in order to permit indirect gravitational effects such as those due to the sun and the moon to be included in the perturbations. The perturbations are given in the form of Fourier series in the arguments of perigee and are associated with each of the zonal harmonics of the earth's gravitational field. The coefficients of the terms of the Fourier series are separable into two functions, one a power series in eccentricity and the other a power series in the inclination as shown by Kaula. The expression for each of these types of

series is given. In order to simplify the calculations, recursion formulas are presented. These formulas show that the evaluation of the terms of the power series can be made in cascade fashion, each successive term being a simple multiple of the preceding one. Finally the contributions to the Lagrange planetary equations due to the long period even and odd zonal harmonics are given.
Author

N70-14493# Stanford Univ., Calif. Operations Research House.
ASYMPTOTIC PROPERTIES OF THE COST FUNCTIONS ASSOCIATED TO ANY INFINITE PATH IN A FINITE GRAPH
S. Rinaldi Sep. 1969 17 p refs
(Contracts N00014-67-A-0112; DAHC-04-67-C-0028; Grants NSF GP-6431; PHS-GM-14789-02)
(AD-693984; TR-69-8) Avail: CFSTI CSCL 12/2

Some asymptotic properties of the cost functions associated to any infinite feasible path in finite, oriented, weighted graphs are derived. Emphasis is given to the properties of the cost function associated to the cycle minimizing the cost of time ratio.
Author (TAB)

N70-14525# California Univ., Berkeley. Operations Research Center.
COMPARISON OF SEVERAL NONPARAMETRIC ESTIMATORS
Richard E. Barlow and Willem R. van Zwet (Leiden Univ.) Aug. 1969 32 p refs Presented at the NATO Conf. on Reliability, Turin, 30 Jun.–4 Jul. 1969
(Contract NONR-3656(18); Grant NSF GK-1684)
(AD-693989; ORC-69-25) Avail: CFSTI CSCL 14/4

Several nonparametric estimators of the failure rate function, assuming that the true unknown failure rate is increasing, are proposed and their asymptotic properties compared. Finite sample comparisons are made using Monte Carlo methods.
Author (TAB)

N70-14531# Technische Hogeschool, Delft (Netherlands). Afdeling der Werktuigbouwkunde.
CURVE-FITTING TECHNIQUES
T. Goemans Nov. 1969 109 p refs
(WTHD-16; THD-KR-200) Avail: CFSTI

In this report the most important aspects of the curve fitting problem are discussed with emphasis on the approximation of a set of discrete data points by means of electronic computers. After an introduction on norms, the setting up of the normal equations encountered in the least square type of approximation is discussed and various ways of solving this set of equations are indicated. The use of orthogonal polynomials is outlined and the gains in both accuracy and computer time to be attained are indicated. A special type of polynomial, the Chebyshev series, is treated into some detail because of their interesting properties with regard to power series telescoping. The relation of Chebyshev approximation to the minimax norm is outlined and a computer program POLLUX, written in CPS, is presented. A second computer program CASTOR is also presented, which is meant for the least squares polynomial approximation of continuous functions. Both POLLUX and CASTOR yield approximations in terms of Chebyshev series.
Author

N70-14552# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ESTIMATION OF THE INFLUENCE OF DISCRETENESS AND METHOD OF NUMERICAL INTEGRATION ON THE ACCURACY OF SOLUTION OF EQUATIONS OF A NON-LINEAR AUTOMATIC CONTROL SYSTEM
N. G. Goncharenko 11 Dec. 1968 21 p refs Transl. into ENGLISH from Vychisliter'naya Tekhn. v Upr. (Moscow), 1966 p 46–55
(AD-694770; FTD-HT-23-731-68) Avail: CFSTI CSCL 12/1

A system of ordinary nonlinear differential equations which describes the motion of an aircraft or another flying object is investigated. Approximate methods are described of selecting the step and the method of numerical integration for the following cases: (1) the solution of a linearized system of equations taking into account the characteristics of special nonlinearities using a digital computer; (2) the solution of a linearized system of equation using a combined analog-digital set.
Author (TAB)

N70-14556# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
STATISTICAL METHODS FOR IMPROVING SIMULATION EFFICIENCY
Donald P. Gaver, Jr. Aug. 1969 23 p refs
(Contract NONR-760(24))
(AD-694445; RR-169) Avail: CFSTI CSCL 12/2

The paper describes a variety of statistical devices for improving the effectiveness of computer simulations of random processes. The methods are illustrated by examples from a queueing problem that is inadequately treated by conventional analytical theory.
Author (TAB)

N70-14560# Stanford Univ., Calif. Dept. of Operations Research.
WEAK CONVERGENCE OF THE AVERAGE OF FLAG PROCESSES
Donald L. Inglehart and Douglas P. Kennedy Jul. 1969 16 p refs
(Contracts N00014-67-A-0112-0031; DAHC-04-67-C-0028) Grant NSF GP-8790)
(AD-693981; TR-7) Avail: CFSTI CSCL 12/2

The principal concern in this paper is obtaining a functional central limit theorem (invariance principle) for the average of a flag process. Applications of flag processes are made to counters, queues, and shot noise.
TAB

N70-14566# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TRANSFORMATION OF THE EQUATIONS OF GENERAL SHELL THEORY TO A FORM CONVENIENT FOR SOLUTION BY THE MESH METHOD
V. A. Rodionova [1969] 7 p refs Transl. into ENGLISH from Math. Mech. (Leningrad), no. 13, 1969 p 124–130
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Modified governing equations of general shell theory using four second-order partial differential equations are described. The modification is based on transverse force vector replacement by the sum of moments gradient, and is convenient for working out algorithms for the numerical solution of shell theory differential equations based on the mesh method. An algorithm is presented for the computation of shells of revolution with variable mechanical and geometric parameters, loading, and components of the stress-strain state, which are represented by Fourier series in the circumferential coordinate. The general shell theory equations are easily extended to dynamic problems, linear anisotropic shells, shell stability in linear formulations, and thermoelastic shell problems.
Author

N70-14579# Illinois Univ., Urbana. Coordinated Science Lab.
ON DUAL OF A GRAPH ON A SURFACE OF GENUS 1
S. Toida Sept. 1969 14 p refs
(Contract DAAB07-67-C-0199)
(AD-693798; R-433) Avail: CFSTI CSCL 12/1

The dual of a graph on a surface of a certain genus is defined. A necessary and sufficient condition for a graph to be drawn on a surface of genus 1 is derived by using the concept.
TAB

N70-14580# Wisconsin Univ., Madison. Dept. of Computer Sciences.
ON THE COMPUTATION OF RIGOROUS BOUNDS FOR THE SOLUTIONS OF LINEAR EQUATIONS WITH THE AID OF INTERVAL ARITHMETIC
Colin W. Cryer Aug. 1969 47 p refs
(Contracts N00014-67-A-0128; DA-31-124-AROD-462)
(AD-694534; TR-70) Avail: CFSTI CSCL 12/1

A method is given for approximately solving linear Fredholm integral equations of the second kind with non-negative kernels. The basis of the method is the construction of piecewise-polynomial degenerate kernels which bound the given kernel. The method is a generalization of a method suggested by Gerberich. When implemented on a computer, interval arithmetic is used so that rigorous bounds for the solution of the integral equations are obtained. The method is applied to two problems: the equation considered by Gerberich; and the equation of Love which arises in connection with the problem of determining the capacity of a circular plate condenser. Author (TAB)

N70-14582# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
BIVARIATE PROBIT, LOGIT, AND BURRIT ANALYSIS
Frederick C. Durling 8 Aug. 1969 117 p refs
(Contract N00014-68-A-0515)
(AD-694438; TR-41) Avail: CFSTI CSCL 6/15

The problem of a mixture of two stimulants in a biological quantal assay is investigated from a mathematical standpoint. The basic assumption is made that the response region does not depend on biological considerations - i.e., given a specified mixture of stimulants z, the response region is defined by the point z in the p-variate space where there are p stimulants under consideration; instead, the probability functions, themselves, may take on different forms. A general form is proposed and investigated. Three analytic models (one utilizing the bivariate normal distribution, one a bivariate logistic distribution developed by Gumbel (1961), and one a bivariate Burr distribution developed by this author) are employed in this investigation. The investigation includes the analysis of data, under the three analytic models, which had been classified by previous investigators as examples of synergistic action, simple similar action, independent action, and additive action. The residual analyses are included as well as the FORTRAN IV subroutines used in evaluating the functions, the partial derivatives and the weights. Author (TAB)

N70-14606# Carnegie-Mellon Univ., Pittsburgh, Pa.
ON ASYMPTOTIC BEHAVIOR OF SOME NUCLEI OF N-PERSON GAMES AND THE PIECEWISE LINEARITY OF THE NUCLEOLUS
A. Charnes (Texas Univ., Austin) and K. O. Kortanek Aug. 1969 19 p refs Prepared in cooperation with Texas Univ. and Northwestern Univ.
(Contracts NONR-760(24); N00014-67-A-0126-0009; Grant NSF-GP-7550)
(AD-694446; RR-170) Avail: CFSTI CSCL 12/2

In a previous paper the authors developed a new class of solution concepts in n-person game theory as optimal solutions to specially constructed linear programming problems whose constraint matrices and hence optimal solutions depend on a certain parameter, c. In this paper asymptotic results are obtained for the limiting payoff configuration as c approaches infinity. It is shown that the limiting payoff configuration in general shares some properties with Schmeidler's solution concept of the nucleolus and under additional assumptions does converge to the nucleolus. By using recent results of Kohlberg, a new proof is obtained for the authors theorem of the piecewise linearity of the nucleolus as a function of the characteristic function of n-person games. Author (TAB)

N70-14610# Stanford Univ., Calif. Dept. of Statistics.
STOCHASTIC STORAGE PROCESSES WITH MULTIPLE SLOPE LINEAR INPUTS AND OUTPUTS
K. L. M. Weldon Aug. 1969 16 p refs
(Contract N00014-67-A-0112-0024)
(AD-693980; TR-9) Avail: CFSTI CSCL 12/1

Let X(t) be the level of the storage process at time t; X(0) = 0. Starting at time 0, the level X(t) increases linearly with slope s sub i for a random length of time (the input period) after which it decreases linearly with slope g sub j for a random time (the output period). Subsequently, the process continues to alternate between periods of input and output where the input-output transitions are governed by a transition matrix P, and the output-input transitions by Q. For each input slope i and output slope j, there corresponds an input period distribution F sub i and an output period distribution M sub j which is exponential. When the zero level is a positive recurrent state, the steady state joint distributions of the level of the process and the slope is obtained. The means of these distributions are determined. The mean nonempty period is also determined. When the zero level is a transient state, the limiting distribution of the storage level is obtained. TAB

N70-14626# Illinois Univ., Urbana. Coordinated Science Lab.
DISPERSION RELATIONS AND MIXED BOUNDARY VALUE PROBLEMS
E. A. Jackson Aug. 1969 38 p refs
(Contract DAAB07-67-C-0199)
(AD-693806; R-426) Avail: CFSTI CSCL 12/1

The connection between dispersion relations and the solutions of the original partial differential equations in finite systems, involving mixed boundary conditions, is discussed. To illustrate this connection, a generalized wave equation is employed, which can exhibit four common forms of dispersion relations. These four cases are examined to illustrate the modifications arising from finite system, possible misconceptions concerning dispersion relations, and the role of retarded (causal) boundary conditions in classifying instabilities. Some mathematical problems of analysis, which apparently have yet to be solved, are also noted. Author (TAB)

N70-14646# Army Electronics Command, Fort Monmouth, N.J. Avionics Lab.
A RANDOM PROCESS FOR OPTIMIZATION
Victor Steve Vajo Sep. 1969 49 p refs
(AD-695654; ECOM-3179) Avail: CFSTI CSCL 12/1

A study was made of a method of optimizing a system by successive comparisons of the system performance for many randomly chosen combinations of the independent parameters. The study involved a Gaussian noise generator to randomly choose the values of the independent parameters. The system was examined for an optimum solution by repetitive operation of the analog computer for randomly chosen combinations of independent parameters. An error function was formed for each solution and the independent parameters for that solution were saved. New values for the parameters were randomly chosen from the Gaussian generator and a new solution was found. If the error for this solution was less than the previous error, the new values of the parameters would replace the old ones. In this manner, the proper values of the independent parameters were found for the maximum error allowable. This method allowed the complete range of interest to be scanned and functioned properly in the system chosen for investigation. The system chosen for investigation was a simplified helicopter feedback control system for a helicopter at hover. Author (TAB)

N70-14688# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
POLYNOMIAL SPLINES ON THE REAL LINE
John H. Ahlberg and Edwin N. Nilson Aug. 1969 20 p refs

(Contract Nonr-526(36))
(AD-694553) Avail: CFSTI CSCL 12/1

The authors extend to ploynomial splines of odd degree existence and boundary properties obtained earlier for cubic spline. Convergence properties similar to those of periodic splines on a uniform mesh are also established for the spline under investigation. The results obtained complement the work of I. J. Schoenberg and other researchers in this field. Author (TAB)

N70-14710# Stanford Univ., Calif. Dept. of Statistics.
SERIATION OF MULTIVARIATE OBSERVATIONS THROUGH SIMILARITIES
Alan E. Galfand 1 Aug. 1969 102 p refs
(Contract Nonr-225(52))
(AD-693985; TR-146) Avail: CFSTI CSCL 12/1

For certain types of problems in multivariate data reduction, seriation and scaling may be reasonable approaches. Given a collection of n objects, seriation techniques try to order these objects on a one-dimensional scale in the sense of assigning a rank from one to n to each object. Scaling techniques attempt to do more by assigning a numerical value to each object so that not only is order achieved but also some quantitative measure of relative closeness is computed. Similarity functions are employed to measure the closeness between pairs of vectors. Two general approaches are considered encompassing five methods. Lastly a section is devoted to several estimation problems that arise from considering the similarities between pairs of vectors as random variables having certain underlying mean and covariance structures. TAB

N70-14716# RAND Corp., Santa Monica, Calif.
DISJOINT COMMON PARTIAL TRANSVERSALS OF TWO FAMILIES OF SETS
D. R. Fulkerson Sep. 1969 18 p refs
(Contract F44620-67-C-0045)
(AD-695444; RM-6102-PR) Avail: CFSTI CSCL 12/2

The theory of flows in networks is applied to obtain necessary and sufficient conditions on two finite families of subsets of a finite set in order that there exist k mutually disjoint common partial transversals, each of size p, of the two families. Author (TAB)

N70-14801*# Minnesota Univ., Minneapolis. Control Science Center.
CONTROL OF DISTRIBUTED-PARAMETER SYSTEMS
David L. Russell 1969 73 p refs
(Contract NONR-3778(00); Grant NGL-24-005-063)
(NASA-CR-107438; TR-1) Avail: CFSTI CSCL 12A

This paper deals with the control of distributed-parameter systems of hyperbolic and parabolic type. The concept of approximate controllability is developed and applied to various physical systems including the string and membrane vibrators. The optimal control problem for linear differential equations in Hilbert Space is explored and related to the bang-bang principle. Author

N70-14809# Syracuse Univ. Research Inst., N.Y.
ALGORITHMIC THEOREM PROVING
R. G. Cantarella *In its* Theory of Adaptive Mech. vol. 2 Nov. 1968 p 77–134 refs (See N70-14804 04-08)
Avail: CFSTI

The advances of the Algorithmic school of theoram proving are presented in a historical study of the development of proof procedures. The connection between proof procedures has been strengthened by an algorithm which, given a realizable equality condition which makes the conjunction of variants unsatisfiable, generates any set of k instantiations over the Herbrand Universe whose conjunction is unsatisfiable. The converse algorithm (which is trivial by comparison) has also been derived. The concept of variant resulution is introduced to provide an efficient procedure which generates all realizable equality conditions (if any) that makes a given conjunction of k variants unsatisfiable. Author

N70-14821# Wisconsin Univ., Madison. Mathematics Research Center.
FUNCTIONS OF PROCESSES WITH MARKOVIAN STATES 3
Martin Fox and Herman Rubin May 1969 21 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-695514; MRC-TSR-987) Avail: CFSTI CSCL 12/1

The definition of the rank of a state of a stochastic process is extended from the discrete case to the general case. Results of Gilbert, Dharmadhikari, and the present authors concerning functions of processes with Markovian states are extended. Only measurability conditions need be added. Author (TAB)

N70-14828# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DYNAMICS OF AN EXTREMAL CONTROL SYSTEM INVARIANT TO PERTURBATION
I. I. Baltrunas et al 11 Dec. 1968 22 p refs Transl. into ENGLISH from Tr. Akad. Nauk Lit. SSR, Ser. B, Fiz.-Mat. Khim. Geol. i. Tekhn. Nauki (Vilna), no. 2, 1966 p 167–177
(AD-695028; FTD-HT-23-714-68) Avail: CFSTI CSCL 12/1

The dynamics and stability of a continuous invariant (with respect to disturbances) extremal control system with synchronous detection of disturbances and with harmonic searching for signals is analyzed in the case where the controlled object has a variable delay, under the assumption that variations in the parameters of the controlled object are sufficiently small (quasi-stationary regime). The control process is optimized with respect to disturbances by continuous automatic adjustment of the correcting device parameters (with respect to their deviations). The problem of the stability of the adjusting process is analyzed for both channels and the stability conditions are established on the basis of the derived equations. It is pointed out that the method used and the results obtained can be used in analyzing certain classes of self-adjusting systems. Author (TAB)

N70-14832# California Univ., Berkeley. Operations Research Center.
MODULES OF COHERENT SYSTEMS AND THEIR RELATIONSHIP TO BLOCKING SYSTEMS
Richard Butterworth May 1969 24 p refs
(Contract Nonr-3656(18); Grant NSF GK-1684)
(AD-693968; ORC-69-11) Avail: CFSTI CSCL 14/4

Some known results concerning modules of coherent systems from reliability are given with new proofs. The relationship of coherent systems to blocking systems is pointed out, as well as an interpretation of modules for blocking systems. Author (TAB)

N70-14838# RAND Corp., Santa Monica, Calif.
A SUFFICIENT CONDITION FOR THE TEMPORAL DECOMPOSITION OF OPTIMUM-CONTROL PROBLEMS FOR LINEAR STOCHASTIC SYSTEMS WITH RESTRICTED CONTROLLERS
J. G. Root Sep. 1969 21 p refs
(Contract F44620-67-C-004523)
(AD-695446; RM-6117-PR) Avail: CFSTI CSCL 12/1

It is shown that the optimum-control problem for linear stochastic sampled-data systems with restricted controllers can be transformed into an ordinary estimation problem, which may in some circumstances be easier to solve. In particular, a sufficient condition is obtained which defines a subset of estimation problems, and hence control problems, for which suboptimizing at each time epoch is in fact an overall optimum strategy. When some state variables are inaccessible, the problems of finding the unconstrained

optimum controller and the optimum linear controller fall into this class. This Memorandum thus provides a common theory and simplified derivations for these problems. Author (TAB)

N70-14842# California Univ., Los Angeles. School of Engineering and Applied Science.
SYNTHESIZING OPTIMAL STRATEGIES IN PURSUIT-EVASION GAMES BY THE EPSILON TECHNIQUE
Yoshiyuki Sakawa and A. V. Balakrishnan 3 Oct. 1969 18 p refs
(Contract AF-AFOSR-1408-68)
(AD-695029; AFOSR-69-2566TR) Avail: CFSTI CSCL 12/2

A constructive method for synthesizing optimal strategies in pursuit-evasion games is described using the epsilon technique as described by Balakrishnan. An illustrative example is worked out. Author (TAB)

N70-14885# California Univ., Berkeley. Operations Research Center.
ESTIMATION OF THE CHANGE POINT OF THE GENERALIZED FAILURE RATE FUNCTION
Subramani Arunkumar Jul. 1969 95 p refs
(Contract Nonr-3656(18); Grant NSF GK-1684)
(AD-693969; ORC-69-16) Avail: CFSTI CSCL 14/4

The change point of a function is defined to be the point (assumed unique) that minimizes or maximizes the function. Fixed and narrow window estimators are proposed and studied for the change point of the generalized failure rate function r(x) = f(x)/g(F(x)/G) where F and G are distributions with densities f and g, respectively. A computer program has been written in FORTRAN IV to obtain estimates of the change point of density and failure rate functions. Several numerical investigations have indicated the superiority of a particular estimator in the case of small samples. TAB

N70-14874# California Univ., Los Angeles. School of Engineering and Applied Science.
AN APPLICATION OF THE BALAKRISHNAN EPSILON TECHNIQUE TO THE SOLUTION OF PURSUIT, EVASION GAMES
Yoshiyuki Sakawa 3 Oct. 1969 28 p refs
(Contract AF-AFOSR-1408-68)
(AD-695033; AFOSR-69-2569TR) Avail: CFSTI CSCL 12/2

Necessary and sufficient conditions for completion of pursuit-evasion games governed by nonlinear differential equations are presented. It is shown that the epsilon method for computing optimal control can be applied for solving the pursuit-evasion games. The existence of the solution for the epsilon problem is proved, and the relation between the original game problem and the epsilon problem is shown. Further, necessary conditions for optimally for the epsilon problem are presented. Author (TAB)

N70-14875# Wisconsin Univ., Madison. Mathematics Research Center.
COMPUTING INVARIANT SUBSPACES OF A GENERAL MATRIX WHEN THE EIGENSYSTEM IS POORLY CONDITIONED
J. M. Varah Feb. 1969 26 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-695865; MRC-TSR-962) Avail: CFSTI CSCL 12/1

A technique is analyzed which computes approximate invariant subspaces for a class of matrices with poorly determined eigensystems. Author (TAB)

N70-14951# California Univ., Berkeley. Operations Research Center
AVERAGE COST SEMI-MARKOV DECISION PROCESSES
Sheldon M. Ross, Sep. 1969 20 p refs
(Contract DA-31-124-ARO-(D)-331)
(AD-695379; ORC-69-27) Avail: CFSTI CSCL 12/2

The Semi-Markov Decision model is considered under the criterion of long-run average cost. A new criterion, which for any policy considers the limit of the expected cost incurred during the first n transitions divided by the expected length of the first n transitions, is considered. Conditions guaranteeing that an optimal stationary (non-randomized) policy exist are then presented. It is also shown that the above criterion is equivalent to the usual one under certain conditions. Author (TAB)

N70-14954# Research Analysis Corp., Mc Lean, Va.
PENALTY METHODS FOR MATHEMATICAL PROGRAMMING IN E TO THE NTH POWER
Anthony V. Fiacco Oct. 1969 27 p refs
(Contract DAHC19-69-C-0017)
(AD-695860; RAC-TP-385) Avail: CFSTI CSCL 12/2

This paper extends the principal supporting results and the general convergence theorems for penalty methods, obtained by Fiacco and McCormick Nonlinear Programming: Sequential Unconstrained Minimization Techniques (1968) for the continuous mathematical programming problem, to the problem of minimizing a mildly regulated objective function over any nonempty subset of E to the n th power. The constraint set need not be defined and the desired minimizing sequence is shown to exist, without additional assumptions (i.e., other than those invoked in the principal convergence theorem of nonlinear programming). A particularly interesting consequence is the fact that a discrete (e.g., integer) programming problem can be solved by a single unconstrained minimization of the auxiliary function. Author (TAB)

N70-14955# Naval Postgraduate School, Monterey, Calif.
PROCEDURES AND STATISTICAL METHODOLOGY OF MODEL VALIDATION
James Matthew Arrison, III (M.S. Thesis) Dec. 1969 52 p refs
(AD-694905) Avail: CFSTI CSCL 12/2

Determining the effectiveness of a computer simulation model in duplicating a desired real world phenomenon is an important unsolved problem. The purpose of this paper is to model the validation procedure in a broad context and develop a general methodology for the statistical part of validation. A procedure calling on utility, decision, simulation, and statistical theories is developed. The goals of statistical testing are presented, and the assumptions, properties, and results of several parametric and nonparametric tests are discussed and compared. Author (TAB)

N70-14956# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
OPTIMUM SEQUENTIAL SEARCH WITH DISCRETE LOCATIONS AND RANDOM ACCEPTANCE ERRORS
Mark W. Smith and John E. Walsh 28 Aug. 1969 22 p refs
(Contract N00014-68-0515; Proj. Themis)
(AD-694441; TR-44) Avail: CFSTI CSCL 12/2

Much work has been done in search theory. However, very little effort has occurred where an objects presence at a location can be accepted when no object is present there. The case analyzed is of this type. The number of locations is finite, a single object is stationary at one location, and only one location is observed each step of the search. The objects location has a known prior probability distribution. Also known are the conditional probability of acceptance given the objects absence (small) and the conditional probability of rejection given the objects presence (not too large); these probabilities remain fixed for all searching and locations. The optimum sequential search policy specifies that the next location observed is one with the largest posterior probability of the objects presence (evaluated after each step from Bayes Rule) and that the object is at the first location where acceptance

occurs. Placement at the first acceptance seems appropriate when the conditional probability of acceptance given the objects absence is sufficiently small. The policy is optimum in that, for any number of steps, it minimizes the probability of no acceptances and, simultaneously, maximizes the probability that an acceptance occurs and the object is accurately located. Search always terminates (with probability one). Optimum truncated sequential policies are also considered. Methods are given for evaluating some pertinent properties and for investigating the possibility that no object occurs at any location. Author (TAB)

N70-14964*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN ANALYTIC MONTE CARLO APPROACH TO PARAMETRIC STUDIES

P. Argentiero Nov. 1969 28 p refs

(NASA-TM-X-63773; X-551-69-493) Avail: CFSTI CSCL 12A

The following is a frequently occurring problem. A random variable Y is assumed to be a deterministic function of a one by N vector of random variables. From information on the multivariate statistical distribution of X, it is desired to answer questions concerning the statistical distribution of Y. If computational problems are surmountable, the most satisfactory solution to the problem is a Monte Carlo one. If this approach is too expensive, then another approach should be considered. It involves obtaining an N-dimensional polynomial fit to data obtained from the simulation program connecting the input variables to the output variable, and obtaining Monte Carlo samples from the fitted polynomial instead of the simulation program. This method was applied to obtain a histogram of the distribution of a minimum fuel midcourse velocity correction of a Venus-72 mission. It is also shown that the down-track and radial track velocity injection errors are the most significant injection errors with regard to their influence on the size of the midcourse correction of such a mission. Author

N70-14970# Florida Univ., Gainsville. Dept. of Industrial and Systems Engineering.

AN AXIOMATIC BASIS AND COMPUTATIONAL METHODS FOR OPTIMAL CLUSTERING Technical Report

Mario Padron Mar. 1969 185 p refs

(Contract DAHC04-68-C-0002)

(AD-694409; THEMIS-UF-TR-18; AROD-T-1-14-RT) Avail: CFSTI CSCL 12/2

This report is concerned with the problem of classifying objects into clusters in such a way that objects within the same cluster are alike and objects in different clusters are relatively dissimilar. A distance or measure of similarity is required in order to measure the degree of likeness of similarity existing between any pair of objects. A clustering criterion or measure of the goodness of any given allocation is developed from basic postulates which attempt to quantify the notions of within group homogeneity and between group heterogeneity. Basic mathematical and experimental properties of the clustering criterion are demonstrated and illustrated. The problem is then imbedded into a mathematical programming formulation which permits the theoretical development of a computational algorithm which converges to an optimal solution for problems of a limited size. With a significant contribution from the algorithm a heuristic method is developed to facilitate the use of the technique for larger problems with a great increase in speed and a very small reduction in accuracy. Several examples are presented to illustrate the properties of the two computational methods developed. Finally, the work presented is compared with other major contributions in this field and suggestions for further research are given. The appendices include three of the major computer programs developed, together with an outline of the problem of grouping objects to minimize an interaction cost, which could be considered a special case of the clustering problem. Author (TAB)

N70-14972# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

DIRECTION AND COLLINEARITY STATISTICS IN DISCRIMINANT ANALYSIS Technical Report

A. M. Kshirsagar 20 Aug. 1968 12 p refs

(Contract N00014-68-A-0515)

(AD-694440; THEMIS-SMU-TR-43) Avail: CFSTI CSCL 12/1

Discrimination among several groups can be achieved with the help of a single optimum linear combination of correlated characters, if and only if all other linear combinations uncorrelated with it have no mean differences among the groups; and so, one is interested often in testing the goodness of fit of a hypothetical linear function for discrimination. The hypothetical function may not be good enough either (a) because the group means are not collinear, or (b) because the direction of the proposed function does not agree with the direction of the line on which the group means lie. Test statistics for these two aspects, (a) and (b), had been derived by Bartlett. In this paper, the distributions of these test statistics are derived by a simple analytical method instead of the geometrical devices used by Bartlett. Author (TAB)

N70-14978# Colorado State Univ., Fort Collins. Dept. of Mathematics and Statistics.

ON THE ESTIMATION OF PARAMETERS IN MIXTURES OF DISTRIBUTIONS Final Report, 1 Jul. 1966 – 30 Jun. 1969

Duane C. Boes 25 Sep. 1969 7 p

(Contract DA-31-124-ARO(D)-472)

(AD-695721; AROD-6431-4-M) Avail: CFSTI CSCL 12/1

The report is divided into the following sections: (1) list of publications, (2) minimax unbiased estimation of the mixed distribution for finite mixtures, (3) on the output of a queueing system, and (4) mixed regression. Author (TAB)

N70-14989# RAND Corp., Santa Monica, Calif.

ON NONTRANSITIVE INDIFFERENCE

Fred S. Roberts Sep. 1969 40 p refs

(Contract F44620-67-C-0045)

(AD-695442; RM-5782-PR) Avail: CFSTI CSCL 5/10

Observed indifference is typically not a transitive relation. Various measurement models, taking account of this observation, are summarized. The relations among the models are discussed. Most of the models are shown to be equivalent. Necessary and sufficient conditions are given for the various models and algorithms are presented for obtaining the desired assignments (numerical and other) from the data. Author (TAB)

N70-14991# North Carolina State Univ., Raleigh. Dept. of Mathematics.

RESEARCH ON NONLINEAR DIFFERENTIAL EQUATIONS Final Report, 1 Sep. 1966 – 31 Aug. 1969

Raimond A. Struble 30 Sep. 1969 7 p refs

(Contract DA-ARO(D)-31-124-G830)

(AD-695707; AROD-4105-38-M) Avail: CFSTI CSCL 12/1

The report summarizes the research efforts under this project and includes discussions of (1) periodic solutions, (2) a function equation, (3) infinitely differentiable functions, (4) equivalence problems, and (5) operations and distributions. Author (TAB)

N70-14992# Stanford Univ., Calif. Dept. of Operations Research.

OPTIMAL CONTROL OF QUEUEING SYSTEMS WITH VARIABLE NUMBER OF EXPONENTIAL SERVERS Technical Report

James T. Mc Gill 24 Aug. 1969 237 p refs

(Contracts Nonr-225(89); Nonr-225(83); Grant NSF GK-2825)

(AD-693893; TR-13) Avail: CFSTI CSCL 12/2

A general switching cost model is formulated, and the problem of characterizing the optimal policy for a certain class of

systems possessing such a cost structure is addressed. The class of systems studied can be described in terms of a pair of state descriptors which render the underlying probabilistic structure Markovian. The state descriptor consists of a one-dimensional variable, called exogenous, which is subject to explicit control by the decision-maker, and a vector of variables, called endogenous, which are only implicitly controlled by the decision-maker. The variable server M/M/c queueing system is an example. In such a system the exogenous variable is the number of servers employed (bounded above by c), and the endogenous variable is the number of customers in the system. The cost structure consists of two components: a variable cost of the system being in a particular state, assumed to be proportional to the length of time spent in that state, and a switching cost incurred instantaneously whenever the value of the exogenous variable is changed. A framework is developed for the analysis of systems where the length of time between review points is a random variable dependent on the state of the system. A characterization of the optimal control policy is given. The M/M/c queueing system is considered in detail and some attention is also given to the GI/M/c queueing system. TAB

N70-14993# Stanford Univ., Calif. Dept. of Statistics.
ON GROUP SEQUENTIAL SAMPLING Technical Report
S. Ehrenfeld 10 Sep. 1969 20 p refs
(Contract Nonr-225(52))
(AD-693994; TR-147) Avail: CFSTI CSCL 12/1

The paper investigates the problem of choosing between two simple hypothesis, H sub o and H sub I, in terms of independent, identically distributed random variables, when observations can be taken in groups. At any stage in the decision procedure it must be decided whether to stop or take action now or to continue, in which case the size of the next group of observations must be decided upon. The problem is to find an optimal procedure incorporating a stopping, group size (batch) and terminal action rule. It is shown that the optimal stopping rule is of the sequential probability ratio type. The special, but important, situation where the log likelihood can assume only a finite number of integral multiples of a constant, is investigated. It is shown that optimum procedures can be obtained by proper formulation of the problem in terms of Markov sequential decision schemes and solved by linear programming. Finally, a policy improvement type of routine is presented when the stopping rule is specified. TAB

N70-15001# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
GOODNESS OF FIT OF DISCRIMINANT FUNCTION FROM THE VECTOR SPACE OF DUMMY VARIABLES
A. M. Kshirsagar 14 Aug. 1969 13 p refs
(Contract N00014-68-A-0515)
(AD-694439; Thems-SMU-TR-42) Avail: CFSTI CSCL 12/1

The problem of discrimination among several groups can be looked upon as the problem of association between the vector of variables under consideration and a vector of dummy or implicit variates representing the differences or contrasts among the groups. In certain situations, observations on one or more of these dummy variables (or their linear combinations) are explicitly available and tests have been derived for the adequacy or goodness of fit of these assigned discriminators from among the dummy variables. In this paper, the statistical distributions of these test criteria have been derived analytically, under the null hypothesis. Author (TAB)

N70-15013# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.
STATISTICS AT TWO POINTS OF THE GRAVITATIONAL OR ELECTRIC FIELD ARISING FROM A RANDOM DISTRIBUTION OF POINT MASSES OR CHARGES
Allan H. Marcus Jul. 1969 25 p refs
(Contract Nonr-4010-09)
(AD-695453; TR-120) Avail: CFSTI CSCL 3/2

Suppose that a random vector field (gravitational, electric) can be represented as the superposition of isotropic disturbances arising from a homogeneous random distribution of points (masses, charges). The characteristic function of the joint distribution at two points in space is derived for an arbitrary force law. For an inverse-square force cut off below a minimum distance (stellar radius), the pairwise longitudinal and transverse covariance functions in three dimensions are especially simple: linear functions of distance at distances less than a stellar diameter, inverse cubic functions of distance at greater distances. Integral representations are derived for pairwise correlations in two dimensions, and triple correlations in three dimensions, for an inverse-square force law cut off below a stellar radius. Author (TAB)

N70-15017# Stanford Univ., Calif. Dept. of Statistics.
ABSTRACT WIENER PROCESSES AND THEIR REPRODUCING KERNEL HILBERT SPACES
G. Kallianpur 8 Aug. 1969 37 p refs
(Grant DA-ARO(D)-31-124-G1077)
(AD-695688; TR-28) Avail: CFSTI CSCL 12/1

The paper explores the relationship between Gaussian processes and their associated RKH Spaces. A simple proof of Grosss theorem on abstract Wiener spaces is given. For a Gaussian measure mu with continuous covariance R defined on the Banach space C(T) of real continuous functions on T (T being a separable complete metric space) it is shown that the closure of H(R) in C(T) is the support of mu. This result is extended to Gaussian measures on arbitrary separable Banach spaces. A necessary and sufficient criterion for a separable Gaussian process x(t) (0 = or < t = or < 1) with continuous covariance R to have continuous sample paths is furnished by the following result to the effect that the canonical normal distribution on H(R) extends to a Gaussian measure on C[0,1) if and only if the sup-norm on H(R) is measurable in the sense of Gross. Author (TAB)

N70-15020# Florida State Univ., Tallahassee. Dept. of Statistics.
RECURSIVE RELATIONS FOR A CLASS OF RANK STATISTICS UNDER LEHNMANN ALTERNATIVES
Lanny D. Larson Jul. 1969 16 p refs
(Contract Nonr-988(08))
(AD-695466; FSU-STATISTICS-M166; ONR-TR-35) Avail: CFSTI CSCL 12/1

Recursive relations for a defined class of rank statistics are developed from which the marginal and joint distributions and the ordinal moments of numbers of the class can be generated. Applications of these relations for some specific members of the class are discussed. Author (TAB)

N70-15026# Ohio State Univ., Columbus. Electroscience Lab.
THE CALCULATION OF THE SPHEROIDAL WAVE EQUATION EIGENVALUE AND EIGENFUNCTIONS Scientific Report
D. B. Hodge 22 Sep. 1969 27 p refs
(Contract F19268-67-C-0239)
(AD-694711; SR-3; TR-2415-4; AFCRL-69-0359) Avail: CFSTI CSCL 12/1

A technique is presented for the calculation of the oblate and prolate spheroidal wave equation eigenvalues and eigenfunctions. The eigenvalue problem is cast in matrix form and a tridiagonal, symmetric matrix is obtained. This formulation permits the immediate calculation of the eigenvalues to the desired accuracy by means of the bisection method. The eigenfunction expansion coefficients are then obtained by a recursion method. This technique is quite simple to program and the computation speed is rapid enough to allow its use as a function subroutine where values not previously tabulated or large numbers of values are required. Author (TAB)

N70-15049# Texas Univ., Austin. Computation Center.
A POLYALGORITHM FOR FINDING ROOTS OF POLYNOMIAL EQUATIONS Interim Technical Report
Belinda M. M. Wilkinson (M.S. Thesis) Aug. 1969 102 p refs
(Grants DA-ARO(D)-31-124-G721; NSF GP-5253)
(AD-695716; AROD-3772-48-M; ITR-22) Avail: CFSTI CSCL 12/1

The roots of a polynomial with complex coefficients are found by applying the inverse power method to a companion matrix associated with the polynomial. If the coefficients are real, tests are performed to determine if a computed root is real or a member of a complex conjugate pair. After all the roots are found, an a posteriori error analysis is performed. Author (TAB)

N70-15060# Yeshiva Univ., New York. Belfer Graduate School of Science.
COMPLEX ANALYSIS Final Scientific Report, 1 Jun. 1966 - 31 May 1969
Harry E. Rauch and D. J. Newman May 1969 6 p refs Submitted for publication
(Grant AF-AFOSR-1077-66)
(AD-695038; AFOSR-69-2614TR; FR-1) Avail: CFSTI CSCL 12/1

During the period from 1 June 66 - 31 May 1968, Rauch was the principal investigator and the principal effort was directed at Riemann surface theory, theta functions and schlicht functions (conformal maps). Results are described in the references listed in this report. During the period 1 June 68 - 31 May 1969, Newman was the principal investigator and research was concentrated in linear search problems, Hilbert spaces of entire functions, completeness problems for the set {f(n,x)} and completeness problems in radical algebras. A summary of results is included in this report. Author (TAB)

N70-15063# North Carolina Univ., Chapel Hill.
ORDER STATISTICS AND NONPARAMETRIC STATISTICS Progress Report, 1 Oct. 1966 - 30 Sep. 1969
Herbert A. David 30 Sep. 1969 6 p refs
(Contract DA-ARO(D)-31-124-G746)
(AD-695955; AROD-2776-60-M; PR-6) Avail: CFSTI CSCL 12/1

This report contains a brief outline of the research findings and lists 35 papers which have resulted from the research. Author (TAB)

N70-15070# California Univ., Los Angeles. School of Engineering and Applied Science.
ON THE CONVERGENCE OF THE RITZ-GALERKIN PROCEDURE IN THE CALCULATION OF OPTIMAL CONTROL BY THE EPSILON TECHNIQUE
Sheng-Chao Huang Aug. 1969 17 p refs
(Grant AF-AFOSR-1408-68)
(AD-695036; AFOSR-69-2564TR; Rept-69-47) Avail: CFSTI CSCL 12/1

The paper investigates the Ritz-Galerkin procedure in obtaining the optimal solution for Balakrishnans Epsilon technique. The optimal control problems with constrainted control and unconstrainted state space are considered. A minimizing sequence for this epsilon problem is constructed and the covergence of the method is proved. Author (TAB)

N70-15078*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
ERROR MECHANISMS FOR CONVOLUTIONAL CODES
Edward A. Bucher (Ph.D. Thesis) 29 Aug. 1969 77 p refs
(Grant NGL-22-009-013)
(NASA-CR-107450; TR-471) Avail: CFSTI CSCL 12A

Upper and lower bounds to the probability of error for convolutional codes are presented. The lower bound is derived from an optimum decoder with convolutional codes in which each of the V channel symbols generated per encoder shift may have a different constraint length. An ensemble average upper bound is derived for multiple generator length convolutional codes with optimum decoding. The Fano sequential decoding algorithm is also investigated. An upper bound to the ath moment of decoder computation is obtained for arbitrary decoder bias B and a < or = to 1. An upper bound on error probability with sequential decoding is derived for both systematic and nonsystematic convolutional codes. This error bound involves the exact value of the decoder bias B. It is shown that there is a tradeoff between sequential decoder computation and error probability as the bias B is varied. It is also shown that for many values of B, sequential decoding of systematic convolutional codes gives an exponentially larger error probability than sequential decoding of nonsystematic convolutional codes when both codes are designed with exponentially equal optimum decoder error probabilities. Author

N70-15090 Arizona State Univ., Tempe.
METHODS FOR DETERMINING POWER SYSTEM STABILITY USING THE THEOREMS OF LIAPUNOV
John Derald Morgan (Ph.D. Thesis) 1969 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-5714

A method for predicting the critical switching time has been presented. It consists of determining the region and extent of asymptotic stability using Liapunov's theorems, and predicts when the Liapunov function would exceed its maximum value for stability, which thus determines the critical switching time. In addition an operational method is developed to determine the stability of a power system following certain switching sequences. A stability coefficient and margin of stability are defined. The methods are applied to several examples illustrating the procedure. Dissert. Abstr.

N70-15092 Virginia Polytechnic Inst., Blacksburg.
MULTI-GROUP NEUTRON TRANSPORT THEORY IN PLANE GEOMETRY
Frank Joseph Mc Crosson, Jr. (Ph.D. Thesis) 1968 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-4599

The method consists of analysing a system of singular integral equations which is derived for the neutron distribution. Included in these singular integral equations are arbitrary inhomogeneous terms which depend only on the angle variable. Once these arbitrary functions are determined, the neutron distribution can be obtained from the singular integral equations by standard methods. To illustrate the procedure the inhomogeneous terms associated with the infinite medium Green's function are determined. The Milne and critical problems are also considered. Here the inhomogeneous terms are expressed in terms of the emerging distribution at the boundary and the emerging distribution is given by a system of coupled Fredholm integral equations. The relationship between this method and Case's eigenfunction method is investigated. This leads to an alternate procedure for determining the expansion coefficients in Case's method. Dissert. Abstr.

N70-15102 Texas Univ., Austin.
CONCERNING UNCOUNTABLE COLLECTIONS OF MUTUALLY EXCLUSIVE COMPACT CONTINUA
Michael Henry Proffitt (Ph.D. Thesis) 1968 38 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-6205

The first seven theorems of this dissertation are concerned with a property related to compact continua in spaces satisfying Axioms 0 and 1 of R. L. Moore's Foundations of Point Set Theory. The other theorems are concerned with uncountable collections of mutually exclusive compact continua in the plane. Dissert. Abstr.

N70-15108 Texas Univ., Austin.
CONCERNING POINTWISE DISCONTINUOUS FUNCTIONS
Bert Dee Garrett (Ph.D. Thesis) 1968 32 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-5144

The concern in this work is with bounded pointwise discontinuous real functions having as initial set a closed interval of the X-axis. The results are presented in two parts, the first containing five characterizations of pointwise discontinuous function and the second containing four characterizations of functions of Baire class 1. Dissert. Abstr.

N70-15110 New York Univ., N.Y. School of Engineering and Science.
APPROXIMATION OF LINEAR TIME-VARYING SYSTEMS BY LINEAR CONSTANT SYSTEMS OVER FINITE TIME INTERVALS
Harry Heffes (Ph.D. Thesis) 1968 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-4564

Methods for reducing the complexity of the class of linear, time varying, dynamic systems are developed where the approach taken is that of uniform approximation (i.e., modeling for classes of inputs and initial conditions). The objective of the modeling procedure is to choose a linear time invariant system, of given dimension, which minimizes a worst-case type of error criterion. The problem with random initial conditions and inputs is also considered. Bounds on the optimal approximation error are obtained as a function of the dimension of the approximating system and the use of these bounds in choosing the order of the approximation is discussed. The theory of widths of sets in Banach space is used in considering the inverse problem, i.e., given a system and an approximation technique, for what subset of the system solutions will the given approximation technique be optimal. Dissert. Abstr.

N70-15111 Arizona State Univ., Tempe.
MEASUREMENT OF THE STATISTICAL PARAMETERS OF LOW-FREQUENCY RANDOM PROCESSES
John Carl Hamilton (Ph.D. Thesis) 1969 164 p
Avail: Univ. Microfilms: HC $7.60; Microfilm $3.00 Order No. 69-5725

Practical engineering techniques for measuring certain statistical quantities for low frequency, stationary, random time series are presented. This treatment is limited to analog methods because the frequency range of interest is from 0.01 Hz to 1 KHz. In particular, measurements of the mean, variance, probability density and spectral density for stationary time series are discussed. For the case of jointly gaussian processes, measurement of the cross spectral density is discussed. Two special procedures are presented. The first deals with the measurement of the autocorrelation function, given the spectral density function of a random process. The other illustrates the use of pseudorandom sequences in linear systems testing. Of special interest is the presentation of details involved in the methods given. Where applicable, practical statistical error analysis is treated clearly and concisely. In each case the ergodic hypothesis is held to be true and the error analyses are based on gaussian statistics. Dissert. Abstr.

N70-15114 Wisconsin Univ., Madison.
OPTIMUM DESIGN OF VIBRATORY SYSTEMS
Bakri Makki Hamad (Ph.D. Thesis) 1968 179 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-15,984

This study deals with the development of strategies for optimum design of close and far-coupled vibratory systems subjected to dynamic excitations. The procedure which has been applied to the two degrees of freedom systems under impulsive, step and sinusoidal forcing functions can be generalized for the design of systems with any number of degrees of freedom subjected to any type of excitations. The extension of this method to more complex problems would be only limited by available computing facilities. Dissert. Abstr.

N70-15140 Arizona State Univ., Tempe.
MARKOVIAN MODELS OF CONDENSATION AND DIFFUSION
Joseph Malcolm Shaffer (Ph.D. Thesis) 1969 68 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-5732

The purpose of this work is to find a general theoretical model which describes both diffusion and condensation with the use of the Markov chain. The extent of the range of the conditional probabilities of transition in the Markov chain is used to distinguish between simple diffusion and higher order processes which may describe either diffusion or condensation. The time rate of change of the variance is used in an averaging relation to differentiate between the two, and thereby find the proper conditions on the coefficients of a differential equation which is generated by differencing on the chain. Several solutions of the simpler equations are investigated. Dissert. Abstr.

N70-15146*# Houston Univ., Tex. Dept. of Mechanical Engineering.
IDENTIFICATION OF SYSTEMS
Bart Childs Aug. 1968 33 p ref
(Grant NGR-44-005-060; Contract N00014-68-A-0151; Proj. Themis)
(NASA-CR-107577; RE-2-68) Avail: CFSTI CSCL 12A

This paper is a tutorial discussion of identification problems. The basic principles of one method of identification are discussed. The method of quasilinearization has been developed by Richard Bellman and Robert Kalaba and others. This method is discussed with emphasis on programming strategies which are intended to improve the utility of a general quasilinearization program. Specific strategies are concerned with expansion of convergence space, superposition of particular solutions, and convergence criteria. Author

N70-15152*# Maryland Univ., College Park. Computer Science Center.
RATES OF CONVERGENCE FOR ITERATIVE METHODS FOR NONLINEAR SYSTEMS OF EQUATIONS
Robert G. Voigt (Ph.D. Thesis) Aug. 1969 182 p refs
(Grants NGL-21-002-008; NSF-GJ-231)
(NASA-CR-207570; TR-69-97) Avail: CFSTI CSCL 12A

The rate of convergence for iterative methods of the form x to the k + 1 = G (x to the k,..., x to the k-m), k = m, m+1,... is considered. Linear convergence theorems are given and applied to some well known iterative procedures, and necessary and sufficient conditions are given for superlinear convergence. Several higher order rate of convergence theorems are given for procedure (1) including sufficient conditions for obtaining the precise order of convergence. These theorems, as well as other techniques, are used to give the precise order of convergence for the secant method and Steffensen's method, in particular. Author

N70-15178# California Inst. of Tech., Pasadena.
SYMMETRIC DESIGNS AND RELATED CONFIGURATIONS
H. J. Ryser Aug. 1969 22 p refs
(Contract N00014-67-A-0094)
(AD-694537) Avail: CFSTI CSCL 12/1

Combinatorial designs are considered which are characterized by a (0,1)-matrix A of order n = or > 3 that satisfies the matrix equation (A superscript T)A = D + ((the square root of (lambda sub i))(the square root of (lambda sub j))), where A superscript T denotes the transpose of A, D denotes the diagonal matrix D =

diag ((k sub 1 - lambda sub 1), (k sub 2- lambda sub 2), ..., (k sub n- lambda sub n)), and the scalars (k sub i - lambda sub i) and lambda sub j are positive. These configurations are called multiplicative designs. They are a natural generalization of the classical symmetric block designs and the recently investigated lambda-designs. Basic properties of multiplicative designs are developed. But the complete structure of these interesting configurations is far from determined. Author (TAB)

N70-18194 Cornell Univ., Ithaca, N.Y.
A NONLINEAR RECURSIVE FILTER FOR TARGETS WITH A BOUNDED FORCING FUNCTION
Max Luria Mintz (Ph.D. Thesis) 1968 51 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-7396

An easily implemented method for improving the performance of the Kalman one step predictor for targets with an unknown bounded forcing function is studied. Discrete measurements of the target state and forcing function are made in independent gaussian noise. A zero memory nonlinear filter is used to preprocess the forcing function measurements. These prefiltered measurements are then combined with the state measurements in a recursive filter. Simulation results are presented to compare this nonlinear recursive filter with the usual Kalman filter. Dissert. Abstr.

N70-18199 Texas Univ., Austin.
DECOMPOSITION OF LARGE-SCALE SYSTEMS OF EQUATIONS
Winston Patrick Ledet (Ph.D. Thesis) 1968 249 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 69-6174

Methods of decomposing large systems by partitioning and tearing in order to facilitate the solution of the system equations are described. Previous work is reviewed and evaluated, and a new method is proposed for ordering the equations (tearing) within each block of equations that must be solved simultaneously. The objective of the tearing was to arrange the equations in a precedence order in which the minimum number of variables would have to be iterated to solve the equations. The proposed method of tearing has proved to be more effective than any method reported in the open literature. A complete algorithm for automatically performing the decomposition of a system including both partitioning and tearing is outlined, and a FORTRAN computer program to execute the algorithm is listed. Dissert. Abstr.

N70-18218*# Houston Univ., Tex. Dept. of Mechanical Engineering.
INVERSE PROBLEMS IN PARTIAL DIFFERENTIAL EQUATIONS
Dennis L. Luckinbill and S. Bart Childs Aug. 1968 95 p refs
(Grant NGR-44-005-060; Contract N00014-68-A-0151; Proj. Themis)
(NASA-CR-107576; RE-1-68) Avail: CFSTI CSCL 12A

A procedure for identification in partial differential equations is described and illustrated by the Laplace equation and the unsteady heat conduction equation. The procedure for solution involves the substitution of difference operators for the partial derivatives with respect to all but one of the independent variables. The linear boundary value problem is solved by superposition of particular solutions. For nonlinear boundary value problems which arise from the original form of the equation or from the identification procedure, a Newton – Raphson – Kantorovich expansion in function space is used to reduce the solution to an iterative procedure of solving linear boundary value problems. For the problems considered, this procedure has proven to be effective and results in a reasonable approximation to the solution of the boundary value problem in partial differential equations. Author

N70-18391*# Wyle Labs., Inc., Huntsville, Ala. Research Div.
AN APPLICATION OF THEORY TO AXIAL COMPRESSOR NOISE. APPENDIX C: BESSEL FUNCTIONS OF THE FIRST KIND: A TABLE OF VALUES FOR ORDERS TO 179 AND ARGUMENTS TO 211
J. B. Ollerhead and C. L. Munch Jul. 1969 116 p
(Contract NAS1-8278)
(NASA-CR-66859; WR-69-15) Avail: CFSTI CSCL 12A

The calculations of harmonic compressor and fan noise are described. In many cases the value of the argument may become very large, exceeding the limits of currently available tables of Bessel Function values. The tables contained have been prepared to provide values covering the expected range of order and argument encountered with common compressor stages. Since the calculation procedure outlined requires the Bessel Function value in intensity form, the tables have been prepared containing the Bessel Function values in this form. Author

N70-18395# Georgia Inst. of Tech., Atlanta. School of Physics.
STOCHASTIC BEHAVIOR OF RESONANT, NEARLY-LINEAR OSCILLATOR SYSTEMS IN THE LIMIT OF ZERO NONLINEAR COUPLING
Joseph Ford and Gary H. Lunsford [1969] 30 p refs Sponsored in part by NSF
Avail: Issuing Activity

The classical motion of physical, nearly-linear oscillator systems governed by specific Hamiltonians is investigated in order to demonstrate that macroscopic irreversibility is an inherent property of such systems even at the limit as gamma tends to zero. A computer study of the case of N = 3 demonstrates that the appearance of resonance overlap causes the system trajectories to wander more or less randomly over part or most of the energy surface. Another result of resonance overlap is that system trajectories originally close to each other in phase space can move apart more or less exponentially with time, so the slightest uncertainty of the initial state leads quickly to complete uncertainty of the final state. Level curve diagrams are included which illustrate the stochastic behavior of specific Hamiltonians. M.H.E.

N70-18448# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
THE ROOTS OF MATRIX PENCILS (AY EQUALS LAMBDA BY): EXISTENCE, CALCULATIONS, AND RELATIONS TO GAME THEORY Research Report
Gerald L. Thompson and Roman L. Weil, Jr. (Chicago Univ.) 22 Aug. 1969 32 p refs Prepared in cooperation with Chicago Univ.
(Contract Nonr-760-24; Grant NSF GS-1541)
(AD-694447; RR-172) Avail: CFSTI CSCL 12/1

Given m x n matrices A and B, by a solution to the pencil system of A relative to B we mean a triple lambda not equal to 0, x not equal to 9, y not equal to 0, where lambda is (x), x is 1 x m and y is n x 1, such that both x(A-lambda B) = 0 and (A-lambda B) y = 0. A canonical form is derived from which it is easy to state conditions for existence of such solutions. By further decomposing the canonical form it is shown that ordinary elimination methods and eigenvalue routines may be used to find pencil solutions. Next the relationship between matrix pencils and matrix games is studied. Finally, the relationship between game theory and dual systems of linear homogeneous equations is developed for both the real and complex cases and applied to pencil systems. Author (TAB)

N70-18484# Wisconsin Univ., Madison. Mathematics Research Center.
GEOMETRIC PROGRAMMING: DUALITY IN QUADRATIC PROGRAMMING AND L SUB P APPROXIMATION III (DEGENERATE PROGRAMS)
Elmor L. Peterson and Joseph G. Ecker May 1969 36 p refs
(Contract DA-31-124-ARO(D)-462)

(AD-695666; MRC-TSR-963) Avail: CFSTI CSCL 12/2

Degenerate quadratically-constrained quadratic programs and l sub p-constrained l sub p-approximation problems are defined and investigated within the framework of extended geometric programming. Author (TAB)

N70-15487# Stanford Univ., Calif. Dept. of Operations Research.
A MODEL FOR ANALYZING SYSTEMS INVOLVING SEQUENTIAL CREWS
Ronald W. Boling 1 Sep. 1969 42 p refs
(Contract Nonr-225(89); Grant NSF GK-2925)
(AD-693983; TR-14) Avail: CFSTI CSCL 5/1

A model is described which can be used to analyze the behavior of sequential crew systems. Such systems consist of two or more crews following one another in a fixed sequence with each crew completing a particular task on a unit being constructed, repaired or serviced. The model is useful in those cases where crew service times can be approximated by one of the family of Erlang distributions. An analysis of the general behavior of sequential crew systems is included. Author (TAB)

N70-15497 Texas Univ., Austin.
A COMPUTATIONAL THEORY OF PLANAR IMBEDDING
John Wade Ulrich (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-6231

The notion of an oriented graph is developed by appending an additional condition to the common motion of a graph. By using this additional condition a computationally simple theory of planar imbedding is developed. If G is an oriented graph then there must exist a subgraph of G which can be imbedded in the plane and which has no fewer edges than any other subgraph of G which can be so imbedded. An algorithm is proposed for finding such a subgraph of G. Dissert. Abstr.

N70-15503# Florida State Univ., Tallahassee. Dept. of Statistics.
STOPPING TIMES OF TWO RANK ORDER SEQUENTIAL PROBABILITY RATIO TESTS FOR SYMMETRY BASED ON LEHMANN ALTERNATIVES
Harrison D. Weed, Jr., Ralph A. Bradley, and Z. Govindarajulu Jul. 1969 27 p refs Prepared in cooperation with Kentucky Univ.
(Contract Nonr-988(08); Grant NSF GP-7847)
(AD-695465; FSU-Statistics-M148; ONR-TR-31) Avail: CFSTI CSCL 12/1

Two, modified, one-sample, rank order SPRTs for symmetry based on Lehmann alternatives are given. The first model (Model I) is discussed by Weed and Bradley (1969) and Weed (1968); the second model (Model II) was proposed by Govindarajulu (1968) and is developed here. The two models depend on two different choices of Lehmann alternatives. The results of this paper were developed independently but, as proofs are essentially the same, the authors have combined their work. It is shown, under very general conditions, that the two procedures terminate with probability one and the moments of stopping times are finite for all alternatives within the classes of alternatives defined by Models I and II. Further, procedures based on approximate probability ratios are also studied when the distribution function at zero under the alternative hypothesis is unknown but estimated from the sample observations. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-14140# Atmospheric Sciences Library, Silver Spring, Md.
AN ANNOTATED BIBLIOGRAPHY OF CLIMATIC MAPS OF BURMA (SUPPLEMENT)
Annie E. Grimes Aug. 1969 29 p refs
(PB-185879; WB-BM-77) Avail: CFSTI CSCL 04B

The report is a supplement to An Annotated Bibliography of Climatic Maps of Burma and is one of a continuing series prepared at irregular intervals by the Foreign Branch, Climatology Division, Environmental Data Service. Author (USGRDR)

N70-14161*# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 104, NO. 1: RESULTS BERLIN-TEMPELHOF, INSTITUT FUER METEOROLOGIE UND GEOPHYSIK OF THE FREIE UNIVERSITAET BERLIN, JANUARY 1969 [METEOROLOGISCHE ABHANDLUNGEN. BAND 104, HEFT 1: ERGEBNISSE DER AUFSTIEGE DER RADIOSONDENSTATION, BERLIN-TEMPELHOF, DES INSTITUTS FUER METEOROLOGIE UND GEOPHYSIK DER FREIEN UNIVERSITAET BERLIN IN JAHRE 1969, JANUAR]
Eugen Pantzke, Richard Scherhag et al Jan. 1969 122 p refs In GERMAN; ENGLISH summary
Avail: CFSTI

The detailed results of the radiosonde ascents performed by the aerological station of the Institut fur Meteorologie und Geophysik der Freien Universitat, Berlin are presented. Using these data monthly time cross sections of the averaged temperature and the zonal meridional wind components in heights above 30 km were constructed. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature and velocity of sound, were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. The data of the ozone-ascents were given in tabular and graphical form. Author

N70-14167# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LAWS OF DISTRIBUTION OF TEMPERATURE AND WIND IN THE BOUNDARY LAYER
T. A. Kurpakova et al 3 Apr. 1969 21 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 205, 1967 p 13–24
(AD-694901; FTD-HT-23-36-69) Avail: CFSTI CSCL 4/2

The laws of the distribution of temperature and wind in the boundary layer of the atmosphere was investigated. It was found that the variation of temperature with height depends both upon stratification and distance from the underlying surface. The application of these relationships in calculating wind shear in the boundary layer as a function of wind speed and stratification in this layer as a function of wind speed and stratification in this layer and in computing the turbulence coefficient in this layer is illustrated. Author (TAB)

N70-14222# Florida State Univ., Tallahassee. Dept. of Meteorology.
SATELLITE STUDY, TROPICAL NORTH ATLANTIC, 1963. PART 3: FREQUENCIES OF ATLANTIC EQUATORIAL CLOUD TYPES, AUGUST 1958
G. A. Dean Aug. 1969 50 p refs
(Grant Cwb-WBG-58)
(PB-185460; Rept-69-2-Pt-3) Avail: CFSTI CSCL 04B

In view of the many difficulties in interpreting cloud types from TIROS and ESSA cloud photographs it appeared appropriate to see if one could gain further insight into this problem through a statistical treatment of a month's surface meteorological reports. The area chosen was the equatorial Atlantic. Specifically, the time period chosen was that of the IGY period for which there exists the most complete publication of meteorological reports. Author (USGRDR)

N70-14227# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ANALYSIS OF SOME CHARACTERISTICS OF THE BOUNDARY LAYER ON THE BASIS OF EXPERIMENTAL DATA

N. A. Lazereva and L. R. Orlenko 27 May 1969 24 p refs Transl. into ENGLISH from Glavnaya Geofizicheskaya Observ., (Leningrad), no. 205, 1967 p 23–35

(AD-695016; FTD-MT-24-08-69) Avail: CFSTI CSCL 4/2

The authors attempt to use experimental data to establish a functional relationship between the height of the boundary layer and the turbulence coefficient, the velocity of the geostrophic wind, atmospheric stratification in the boundary layer, and the roughness of the underlying surface. The dissipation parameter is also determined; this parameter characterizes the relationship between the components of the balance equation for turbulent energy. The relationships are determined by analyzing the dimension determining the magnitudes which are represented by the equations. The experimental data consisted of radiosonde observations under non-advective conditions. The determination of the height of the dynamic boundary layer is discussed on the basis of the Ekinan spiral. The dependence of the height of the boundary layer upon the velocity of the geostrophic wind is expressed by equations. In the determination of the dependence of the height of the boundary layer there is examined the function. Author (TAB)

N70-14373# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

TENTH METEOROLOGICAL YEARBOOK [TENTH ANNUARIO METEOROLOGICO]

G. Bollini and C. Gandino Aug. 1969 103 p refs In ITALIAN; ENGLISH summary

(EUR-4293i) Avail: CFSTI

After a short description of the methods for measuring and elaborating atmospheric phenomena, many tables and graphics for the meteorological year 1968 are reported. With the observatory's data, temperature measurements at screen No. 4, 45 m lower, the flow of the Novellino brook and the wind-data, at 120 meters level of the meteorological tower, are added. Author

N70-14496# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF TURBULENCE ON VERTICAL WIND PROFILE IN CLOUDS

S. M. Shmeter 21 May 1969 21 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ., (Moscow), no. 71, 1966 p 48–57

(AD-695031; FTD-MT-24-506-68) Avail: CFSTI CSCL 4/2

An approximate estimate is made of the possible deviations of the wind speeds and directions in clouds (stratus and cumulonimbus) from the winds in zones located outside of clouds in which the winds are assumed to be geostrophic. These calculations show that the turbulent transfer of momentum causes a significant decrease in the vertical wind gradient within clouds as compared to that outside the clouds. Wind shifts occur simultaneously in the clouds with the change in gradient. Wind data collected by S. M. Schmeter using airborne Doppler equipment are compared with the estimates made in the present paper and are found to be comparable. Author (TAB)

N70-14501# National Weather Records Center, Asheville, N.C.

CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW ONE-HALF MILE AND CEILINGS BELOW 200 FEET, VOLUME 26 Final Report

Jun. 1969 33 p refs

(Contract AF-67-WAI-129)

(AD-695430; SRDS-RD-69-22-vol-26; FAA-RD-69-22-vol-26) Avail: CFSTI CSCL 1/5

The report contains climatological data for the Newark Airport, Newark, New Jersey. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation. Author (TAB)

N70-14502# National Weather Records Center, Asheville, N.C.

CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW ONE-HALF MILE AND CEILINGS BELOW 200 FEET, VOLUME 27 Final Report

Jun. 1969 32 p refs

(Contract FA-67-WAI-129)

(AD-695431; SRDS-RD-69-22-vol-27; FAA-RD-69-22-vol-27) Avail: CFSTI CSCL 1/5

The report contains climatological data for the New Orleans International Airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation. Author (TAB)

N70-14530# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

IMMEDIATE PROSPECTS OF CLIMATOLOGICAL DEVELOPMENTS IN COMPUTERS AND THE NECESSARY MEMORY FORMS

S. A. Sapozhnikova 25 Apr. 1969 13 p Transl. into ENGLISH from Tr. Nauchn. Issled. Inst. Aeroklimatologii (USSR), no. 48, 1967 p 3–7

(AD-695893; FTD-MT-24-103-69) Avail: CFSTI CSCL 4/2

The probable future uses of presently accumulated climatological data are discussed and methods of processing these data with the aid of punch card equipment as well as with the Razdan-2 and Ural-14-B electronic computers are briefly examined. Author (TAB)

N70-14588# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CALCULATION OF METEOROLOGICAL INSTRUMENTS

I. A. Pokrovskaya et al 11 Jul. 1969 16 p refs Transl. into ENGLISH from Glavnaya Geofiz. Observ. (USSR), no. 218, 1967 p 167–178

(AD-694780; FTD-MT-24-02-69) Avail: CFSTI CSCL 4/2

The history and role of the Main Geophysical Observatory in the calibration of meteorological instruments is reviewed, with some emphasis on the Observatorys role in maintaining and using the USSRs meteorological instrument standards. Two trends prevail in the improvement of instrument calibration: the first is the improvement of calibration accuracy and the other is the development of an effective calibration method with an eye to the man-hours involved while still trying to maintain the necessary accuracy. Author (TAB)

N70-14589# Wisconsin Univ., Madison. Mathematics Research Center.

THE RIEMANN ZETA-FUNCTION MAGNETIC TAPES

D. R. Musser, J. Barkely Rosser, and Lowell Schoenfeld May 1969 21 p refs

(Contract DA-31-124-ARO(D)-462)

(AD-695516; MRC-TSR-967) Avail: CFSTI CSCL 12/1

This report describes 8 reels of magnetic tape containing assorted information relating to the Riemann function zeta (s). These data suffice to prove that the first 3,502,494 zeros of zeta (s) above the real axis all lie on the critical line. The eighth reel contains corresponding information for 13,400,000 > or = | >

of = 13,441,499. With the aid of this and a small amount of additional data, it is possible to prove that all zeros beta + i gamma of zeta (s) are such that beta = 1/2. Author (TAB)

N70-14872# Army Foreign Science and Technology Center, Washington, D.C.

ON THE ORGANIZATION OF DATA SEARCH IN THE CONSTRUCTION OF THE SYSTEM OF AUTOMATIC PROCESSING FOR METEOROLOGICAL INFORMATION

K. A. Semendyaev and O. M. Kastin 19 Sep. 1969 10 p refs Transl. into ENGLISH from Gidrometeorologicheskii Nauchno-Issledovatelskii Tsentr SSSR, Tr., (Russian) no. 1, 1967 p 80-83

(AD-695091; FTD-HT-23-491-69) Avail: CFSTI CSCL 4/2

The data-research organization is examined for a system of automatic processing of meteorological information. A compact machine dictionary of station indexes is utilized to reduce machine research time. The search program and the contents of the dictionary for aerological and synoptic stations are described. Author (TAB)

N70-14912*# Air Weather Service, Scott AFB, Ill.

USE OF THE SKEW T, LOG P DIAGRAM IN ANALYSIS AND FORECASTING

15 Jul. 1969 140 p refs

(AD-695603; AWSM-105-124) Avail: CFSTI CSCL 4/2

The manual provides guidance on the use of the Skew T, Log P Chart, DOD WPC 9-16, and on the principles of radiosonde analysis for forecasting of clouds and convection-weather phenomena. Chapter 3 establishes standard methods to be used when entering data on Skew T Charts. This manual will serve all AWS forecasters and observers as a general reference updating and revising previous publications on the subject, as study material for use in OJT and school training, seminars, etc., and as a source of hints on parameters and approaches for local forecast studies or techniques. Author (TAB)

N70-14922# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

SYNOPTIC-SCALE WEATHER DISTURBANCES THAT INFLUENCE FIRE CLIMATE IN SOUTHEAST ASIA DURING NORMALLY DRY PERIODS

Morris H. Mc Cutchan and Robert S. Helfman 1969 74 p refs

(AD-696086) Avail: CFSTI CSCL 4/2

Fire climate is affected by temperature, humidity, windspeed, precipitation, and cloud cover. In Southeast Asia, the two major factors are rainfall and cloud cover. The scope of this study was to determine when, how long, and by what mechanism the normally dry period in SEA is interrupted by rain and clouds. The report investigates the origins, frequency, persistence, dissipation, dynamics and kinematics, and the associated fire climate of the synoptic-scale disturbance. Author (TAB)

N70-15000# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.

CEILING/VISIBILITY RECURRENCE AND DIURNAL VARIATION Research Report, Feb. - May 1969

Cyrus R. Mc Allister 11 Jul. 1969 31 p

(Contract F04701-69-C-0066)

(AD-695017; TR-0066(5520-05)-1; SAMSO-TR-69-30123) Avail: CFSTI CSCL 04/2

Estimators of conditional probabilities of recurrence of combined ceiling/visibility conditions associated with 8000 feet and 5 miles, respectively, are presented and tested against samples of data representative of semitropical climatological regimes. The estimators are shown to be reasonably efficient in the sense that about 95% of the achieved estimates fall within plus or minus 0.03 of observed values of the conditional probabilities. The results are contrasted with the higher degree of efficiency arising through application of similar methodology to cloud-cover amounts, where the comparable level was found to be 95% within plus or minus 0.02 for a large sample of northern hemispheric data. Author (TAB)

N70-15048*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CAPE KENNEDY WIND COMPONENT STATISTICS: MONTHLY AND ANNUAL REFERENCE PERIODS FOR ALL FLIGHT AZIMUTHS FROM 0 TO 70 km ALTITUDE

S. C. Brown 9 Oct. 1969 176 p Supersedes R-AERO-Y-118-66

(NASA-TM-X-53956; R-AERO-Y-118-66) Avail: CFSTI CSCL 04B

Head-, tail-, and cross-wind component speeds for Cape Kennedy are tabulated for all flight azimuths for altitudes from 0 to 70 km by monthly and annual reference periods. Wind speeds are given for 11 selected percentiles ranging from 0.135 percent to 99.865 percent for each reference period. The data were prepared for application to space vehicle dispersion analysis and pitch (or yaw) program bias to minimize vehicle structural and control loads due to wind. Author

N70-15078# Edgerton, Germeshausen and Grier, Inc., Boulder, Colo. Environmental Services Operation.

AIRBORNE MEASUREMENTS OF ATMOSPHERIC ANOMALIES

Jul. 1969 111 p refs

(Contract F19628-68-C-0321)

(AD-694093; ESD-TR-69-194) Avail: CFSTI CSCL 4/2

The purposes of the investigation were (1) to define the hazards anomalies of the atmosphere with respect to their bearing ontracbig problems. (2) define tracbing accuracies at lower limits elevation angles zero to 5 degrees. (3) assess currently employed refraction correction techniques. Author (TAB)

N70-15083# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.

METEOROLOGICAL DATA. VOLUME 91, NO. 4: ATMOSPHERIC PRESSURE MODULATION BY THUNDERSTORMS [METEOROLOGISCHE ABHANDLUNGEN. BAND 91, HEFT 4: MODULATION DES LUFTDRUCKS DURCH GEWITTER]

Heike Roeling Apr. 1969 63 p refs In GERMAN; ENGLISH summary

Avail: CFSTI

Barograms of Sleswick, Emden, Hanover, Essen, Kassel, Hof, Stuttgart, and Ratisbon show that in the period of November 1964, to April, 1967, 202 (or 37%) of 552 thunderstorms were accompanied by a special pressure effect. The diurnal variations of thunderstorm activity can also be determined. The minimum amount occurs between 6 a.m. and 9 a.m. (GMT) in the interior and between 3 a.m. and 6 a.m. in the coastal areas. In the whole region, most thunderstorms appear between 12 noon and 3 p.m. In the coastal areas, this is followed by a second minimum activity between 3 a.m. and 6 p.m. and by a second maximum period between 6 p.m. and 9 p.m. Meso-scale pressure changes are considered for separate thunderstorm highs. Thunderstorm areas of such a kind enclose several 1000 sq km. It is imperative to observe meso-scale pressure changes in some thunderstorm situations, since not all fronts give rise to thunderstorm activity at all times. Since the pressure effect of the thunderstormsphere is sometimes erroneously linked to the post-frontal pressurized zone, thunderstorms are often found to occur on the wrong side of the front. Meso-scale analysis of this nature is still barely made possible by the density of the network of the Middle European Meteorological Stations. Difficulties can occur because observations are carried out only at the interval of every three hours. Author

N70-15122# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FAR EASTERN REGIONS, KAMCHATKA AND SAKHALIN

A. A. Zanina 30 Apr. 1969 208 p refs Transl. into ENGLISH from Klimat SSSR, (Russian), v. 6, 1958 p 1–167
(AD-694887; FTD-MT-24-476-68) Avail: CFSTI CSCL 4/2

The monograph contains a characterization of basis climate creating factors (peculiarities of radiation conditions, circulatory processes, and the influence of relief and seas washing land areas), a brief general characterization of climate by seasons, and a brief description of separate elements of climate (thermal conditions, wind conditions and humidity) of the Far East. It also includes regionalizing of territory and a description of the climates of separate regions. The monograph includes the following: 1. European territory, 2. Caucasus, 3. Central Asia, 4. Western Siberia, 5. Eastern Siberia, 6. Far Eastern regions, Kamchatka, and Sakhalin. It is intended for scientists - climatologists, agricultural meteorologists and geographers, also for students of higher educational institutions.
Author (TAB)

N70-15155# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
COLD REGION SCIENCE AND ENGINEERING MONOGRAPH 1-A: CHARACTERISTICS OF THE COLD REGIONS
Robert W. Gerdel Aug. 1969 61 p refs
(AD-695661; CRREL-CRSE-1-A) Avail: CFSTI CSCL 4/2

The monograph gives a brief introduction to total cold environments preparatory to the more detailed treatments of the later works in the series Cold Regions Science and Engineering. The authors photographs are particularly effective and a selected bibliography of 64 references gives overall coverage.
Author (TAB)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-14128*# Massachusetts Inst. of Tech., Cambridge. Measurements System Lab.
UNCERTAINTY ESTIMATION VIA PREFLIGHT TEST PROCEDURES FOR A SPACE STABILIZED INERTIAL NAVIGATION SYSTEM
Henry K. Johansen Aug. 1969 75 p ref
(Grant NGR-22-009-229)
(NASA-CR-107311; RE-59) Avail: CFSTI CSCL 17G

A space stabilized inertial navigation system is used in VTOL aircraft where flight times of a maximum of one and a half hours duration is expected. This report deals with the usefulness of a preflight test run on a stationary base lasting less than 20 minutes in estimating the I.N.S. uncertanties. The use of data from the alignment phase is also discussed. A simple estimation procedure not including any optimal filtering techniques is assumed. The error propagation for a maximum one and a half hour run is derived when compensation signals with and without a succeeding realignment of the platform is applied.
Author

N70-14265# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
BEACON NUMERICS ON RBDE-5 DISPLAY Final Report
Joseph J. Scavullo Dec. 1969 149 p
(NA-69-44; SRDS-RD-69-54) Avail: CFSTI

This project was to develop and implement for test, modifications and additions to the Air Traffic Control Beacon Interrogator and the Radar Bright Display Equipment so as to provide 4096 beacon identity decoding, altitude decoding, and target related presentation of identity and altitude numerics on the controller's display in an en route environment where the modified equipment could be used as a tool during an evaluation of the operational utility of beacon numerics and the associated air traffic control procedures.
Author

N70-14292*# Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
DEVELOPMENT OF AN EVALUATION TECHNIQUE FOR STRAPDOWN GUIDANCE SYSTEMS Interim Report, 1 Feb. 1968 – 1 Feb. 1969
Ellis F. Hitt, Fred G. Rhea, and J. N. Blutreich 28 Feb. 1969 270 p refs
(Contract NAS12-550)
(NASA-CR-86286; IR-2) Avail: CFSTI CSCL 17G

The evaluation techniques developed for pure strapdown inertial guidance systems have been extended to permit evaluation of astrionics systems which utilize aided inertial guidance systems. These techniques consider mission requirements, mission event schedules, and spacecraft design characteristics. The techniques provide a measure of astrionics system performance, aid in evaluation of competitive subsystems and in the preliminary design of conceptual subsystems, and are used in determination of the effectiveness of specific navigation updating and midcourse correction schedules. Effectiveness evaluation is based on a cost effectiveness approach with cost defined as total astrionics system weight and effectiveness defined as probability that the astrionic system operates correctly. Using this cost or weight effectiveness model, several performance indices have been developed. These may be broken into two categories. The first category requires a specified effectiveness or probability of success and uses weight as the performance index, while the second category has a specified weight allowance for the astrionics and uses the ineffectiveness or probability of failure as the performance index.
Author

N70-14353# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GYROSCOPIC DEVICES OF BALLISTIC MISSILES
V. V. Yagodkin et al 25 Apr. 1969 227 p refs Transl. into ENGLISH from the Russian
(AD-694902; FTD-HT-24-378-68) Avail: CFSTI CSCL 17/7

This book is intended for people interested in problems of rocket and missile guidance. The principal types of gyro-devices for guiding modern ballistic rockets are discussed. Data is presented on structural plans of guidance systems, their specific parts, and their functions. Much attention has been paid to physical principles of operating gyro-devices, factors affecting their accuracy, and hydrostabilizers as the principal master-measuring devices of modern rockets. The book is based on open Soviet and Western materials.
Author (TAB)

N70-14408*# Ohio Univ., Athens. Dept. of Electrical Engineering.
AUTOMATIC TEST AND PLANNING PROCEDURES FOR NAVIGATION AND AIR TRAFFIC CONTROL SATELLITES Bibliography
G. V. S. Raju Jun. 1969 45 p refs
(Contract NAS12-2082)
(NASA-CR-6282; EER-IS-1) Avail: CFSTI CSCL 17G

Probabilistic network techniques have been proven successful in control of test and countdown procedures for the Apollo launching. The network pattern facing satellites in controlling navigation and air traffic requires a similar approach. Automatic procedures applied to navigation and air traffic control are surveyed. This literature search emphasizes GERT techniques, sensitivity and reliability analysis, and the utilization of satellites for navigation and air traffic control.
Author

N70-14928*# Dynamics Research Corp., Wilmington, Mass.
OPERATIONAL ALIGNMENT AND CALIBRATION OF THE ISU FOR PHASE 2 OF THE V/STOL PROGRAM. VOLUME 2: ALIGNMENT

Donald O. Benson, Jr. and H. James Rome Dec. 1969 163 p refs
(Contract NAS12-2150)
(NASA-CR-86303; R-106U-Vol-2) Avail: CFSTI CSCL 17G

A detailed design and study of an alignment scheme to be used for the strapdown inertial system for phase 2 of the V/STOL program are presented. The alignment scheme which was selected was capable of being implemented on the onboard, fixed point computer and also yielded alignment errors which were close to their theoretical minima within 15 minutes of alignment time. A three-stage alignment scheme which employs least squares algorithms was found which meets these criteria. Both a theoretical error analysis employing Kalman filter estimation theory and a computer simulation were used to demonstrate the effectiveness of the scheme. Confidence in the results was established by the fact that the theoretical covariance results and the simulation results are consistent. The performance of the three-state scheme is shown to compare favorably with an optimal alignment scheme in the theoretical covariance analysis. An equation set for the self-contained alignment scheme is described, and alternative computer implementations for data batch processing are discussed.

Author

N70-15225*# TRW Systems Group, Redondo Beach, Calif. Control Systems Analysis Section.
THE USE OF MAGNETIC TORQUING FOR CONTROL MOMENT GYRO DESATURATION
R. E. Goetz 5 Dec. 1969 65 p refs
(Contract NAS9-8166)
(NASA-CR-102075; TRW-11176-H411-R000) Avail: CFSTI CSCL 17G

The feasibility of using a magnetic torquing system for control moment gyro momentum dumping was investigated. The necessary control laws for such a system were derived, and a simple control system design is presented. Calculations for sample torquers were performed to obtain some physical basis for comparison of three types of torquers: coreless, solenoidal ferrite, and spherical ferrite. Coreless torquers do not become advantageous until their size approaches 10 meters. While ferrite core torquers are smaller than coreless torquers of sufficient diameter, they are, in general, heavier, have higher power requirements, and will produce higher magnetic fields within the vehicle than the coreless torquers. Magnetic torquing was found to be practical for its designed purpose within the stated guidelines and assumptions.

Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-14118# Idaho Nuclear Corp., Idaho Falls. Reactor Engineering Branch.
REACTOR ENGINEERING BRANCH Annual Report, Fiscal Year 1968
E. D. Covington, ed. Feb. 1969 184 p refs
(Contract AT(10-1)-1230)
(IN-1228) Avail: CFSTI

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1. MATERIALS RESEARCH p 1-19 refs (See N70-14119 04-22)
2. REACTOR FUELS AND MATERIALS DEVELOPMENT p 20-73 refs (See N70-14120 04-22)
3. ENGINEERING EXPERIMENTS p 74-110 refs (See N70-14121 04-22)
4. REACTOR TRAINING p 111-113 (See N70-14122 04-22)
5. CRITICAL FACILITIES p 115-147 (See N70-14123 04-22)

N70-14119# Idaho Nuclear Corp., Idaho Falls. Reactor Engineering Branch.
MATERIALS RESEARCH
In its Reactor Eng. Branch Feb. 1969 p 1-19 refs (See N70-14118 04-22)
Avail: CFSTI

In H2 embrittlement studies, irradiation of specimens increased the rate of H2 occlusion and the apparent solubility after cathodic charging. Increased H2 content from 0.2 to approximately 7 ppM resulted in a loss in ductility (reduction in area) of the unirradiated steels but without marked increase in the as-received material of susceptibility to hydrogen-induced cracking. Modification of the microstructure by heat treatment of A542 carbon steel resulted in a tendency toward hydrogen-induced cracking. Specimens of cladding and structural materials for pressure vessels and high temperature usage are being irradiated in EBR-II for post-irradiation fatigue tests principally in support of the fast reactor program, although carbon steel specimens are also contained in the first two subassemblies.

Author (NSA)

N70-14120# Idaho Nuclear Corp., Idaho Falls. Reactor Engineering Branch.
REACTOR FUELS AND MATERIALS DEVELOPMENT
In its Reactor Eng. Branch Feb. 1969 p 20-73 refs (See N70-14118 04-22)
Avail: CFSTI

The use of Al-B foils, fabricated by power metallurgy procedures, and incorporated in the fuel plate between two halves of wrought Al-U alloy is being investigated as a possible fuel fabrication technique for the ETR. Irradiation results indicate the first iteration. The matter is then reduced to solving two eigenvalue problems. Theoretical and numerical comparisons with Henry's adiabatic model outline the main role of perturbed adjoint fluxes and correct neutron flux shape (the second agent only for superpromptcritical excursions) in defining the generation time and reactivity. When compared with the exact solution, results of sample problems show substantial accuracy in the flux shape and amplitude. In subpromptcritical excursions, only the synthesis method is as accurate as the metastatic one and yields errors of few percent at the flux peak. In the reactivity range above prompt critical, differences between the exact results and the metastatic ones are unessential.

Author (NSA)

N70-14121# Idaho Nuclear Corp., Idaho Falls. Reactor Engineering Branch.
ENGINEERING EXPERIMENTS
In its Reactor Eng. Branch Feb. 1969 p 74-110 refs (See N70-14118 04-22)
Avail: CFSTI

Experimental and analytical fuel element investigations have been directed toward better defining the ATR operating conditions and limits. Local coolant flow rates were measured in the ATR core and factored into the computer code used in fuel element thermal hydraulic analysis.

Author (NSA)

N70-14122# Idaho Nuclear Corp., Idaho Falls. Reactor Engineering Branch.
REACTOR TRAINING
In its Reactor Eng. Branch Feb. 1969 p 111-113 (See N70-14118 04-22)
Avail: CFSTI

An ATR simulator consisting of duplicate console and analog computer for training reactor operators is described.

Author (NSA)

N70-14123# Idaho Nuclear Corp., Idaho Falls. Reactor Engineering Branch.
CRITICAL FACILITIES
In its Reactor Eng. Branch Feb. 1969 p 115–147 (See N70-14118 04-22)
Avail: CFSTI

Increasing reactor coolant temperature had only a small effect on shim and safety rod worths; however, the outer shim worths increased significantly when the experiment loop temperatures were raised. Measurements in typical ATR experiment irradiation positions show that fast neutron flux and gamma heating can be predicted from low power measurements in the ATRC within 5 and 20%, respectively. The power spectral density, from zero-power noise measurements, shows prominent resonances attributed to flow-induced vibrations of the in-pile experiment tubes. Power distribution measurements in the ATRC show that the core hot-spot power generation can be reduced 18% by using radially zone-loaded fuel elements, without affecting the fission rate in adjacent loop experiments. Author (NSA)

N70-14249*+ Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
NERVA DEVELOPMENT STATUS
W. H. Esselman 1968 20 p Presented at the Am. Nucl. Soc. and Profess. Engr. Soc., Cocoa Beach, 23 Feb. 1968 Sponsored by NASA
(NASA-CR-107403; WANL-W-89; Conf-680214-1) Avail: CFSTI CSCL 21F

The basic operation of a nuclear reactor rocket system is reviewed, and the status of the NERVA development program is assessed. Technical objectives of structural integrity and reactor endurance capability, engine restartibility, and predictibility and controllability of the system are discussed, and future development potential is examined. Author (NSA)

N70-14251# Atomic Energy Commission Research Establishment, Riso (Denmark). Reactor Physics Dept.
HEBUS; A 3-DIMENSIONAL HETEROGENEOUS BURNUP AND SHUFFLING PROGRAMME
J. Pedersen Mar. 1969 34 p refs
(RISO-M-864) Avail: CFSTI

A description is given of the program HEBUS, which is a combination of the point burn-up program PBU, the 3-dimensional heterogeneous program SOUSI 3DR, and procedures for loading, unloading and shuffling of fuel elements. Author

N70-14298# Atomic Energy of Canada, Ltd., Chalk River, (Ontario). Nuclear Labs.
GRAPHITE IN NUCLEAR FUELS
J. A. L. Robertson *In its* Mater. Res. at Chalk River Oct. 1969 p 8–10 *ref* (See N70-14293 04-17)
Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

Plutonium produced in power reactors (and U-233 when the thorium cycle comes into use) may be separated from the spent fuel elements and fed back to the reactors. Microspheres of the fissile materials can be incorporated in a graphite matrix. One promising application is for superheating steam. Author

N70-14339+ Aerojet-General Corp., Sacramento, Calif. Nuclear Rocket Operations.
RESULTS OF NRX-A6 FLAME-SPRAY EVALUATION TEST
H. A. Fox, Jr. 10 May 1968 16 p refs
(RN-TM-0564) Avail: CFSTI

The results of the NRX-A6 flame spray tests are presented. The general objective was to determine the effectiveness of a flame sprayed aluminum coating used to provide a thermal path between gamma heated sheathed cables and the reactor pressure vessel. The effects during the maximum power steady state period of EP-IIIB, when the heating rates were maximum were determined. Flame sprayed Al effectively reduced cable and conductor temperatures to the temperature of the pressure vessel surface. Temperature of the cables was 50% less than predicted. Flame spraying proved to be a satisfactory method for securing cables and temperature transducers to engine surfaces. Author (NSA)

N70-14399# Atomic Energy Commission Research Establishment, Riso (Denmark). Reactor Physics Dept.
CALCULATION OF HETEROGENEOUS CONSTANTS FOR CYLINDERS AND SLABS
J. Pedersen 27 Jan. 1969 26 p refs
RISO-M-850 Avail: CFSTI

A method for computing the heterogeneous constants for fuel or control elements by collision probability theory is given. These constants are directly used in heterogeneous reactor codes, but it is also shown, that they may be used for a consistent calculation of cell average cross sections and diffusion constants. A computer code HECS (Heterogeneous Constants) being able to compute cylindrical monopoles or dipoles and slabs with symmetrical or skew symmetrical flux distributions, is described. Author

N70-14400*+ Los Alamos Scientific Lab., N.Mex.
CMF-13 RESEARCH ON CARBON AND GRAPHITE Progress Summary Report, 1 May–31 Jul. 1968
Morton C. Smith 4 Sep. 1968 36 p Sponsored in part by NASA (Contract W-7405-eng-36)
(NASA-CR-107356; LA-3989-MS; PSR-6) Avail: CFSTI CSCL 18J

Results of research and development on the properties and behavior of C and graphite for use as nuclear engineering materials are reported. Information is included on raw material processing and fabrication techniques, evaluations of the properties of binders and fillers, mixing processes, and heat treatments. Extrusion parameters are shown graphically and results of microstructural studies and measurements of physical and mechanical properties are tabulated. NSA

N70-14504# Atomic Energy Commission, Oak Ridge, Tenn. Technical Information Div.
ABUNDANT NUCLEAR ENERGY
May 1969 347 p refs Presented at the Proc. of a Symp., Gatlinburg, Tenn., 26–29 Aug. 1968
Avail: CFSTI

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2. ENERGY INTENSIVE AND HEAT INTENSIVE PROCESSES FOR A NUCLEAR ENERGY CENTER J. M. Holmes (Oak Ridge Natl. Lab., Tenn.) p 29–43 refs (See N70-14506 04-22)
3. PHOSPHORUS M. M. Striplin, Jr. (Tenn. Valley Authority) p 47–66 refs (See N70-14507 04-22)
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8. PRODUCTION OF AMMONIA USING LOW-COST NUCLEAR ENERGY G. M. Blouin (Tenn. Valley Authority) p 123–134 refs (See N70-14512 04-22)
9. ALUMINUM J. R. Chapman (Aluminum Co. of Am.) p 137–161 refs (See N70-14513 04-07)
10. MAGNESIUM S. Fougner (Magnalith Corp.)

p 163–180 refs (See N70-14514 04-17)

11. IRON AND STEEL WITH HYDROGEN A. M. Squires (City Coll. of the City of New York) p 181–196 refs (See N70-14515 04-17)

12. ELECTROWINNING OF METALS J. B. Rosenbaum (Bureau of Mines, Salt Lake City, Utah) p 197–201 refs (See N70-14516 04-17)

13. A BLEACHED STRAW PULP MILL FOR AN AGRO-INDUSTRIAL COMPLEX J. N. Mc Govern (Parsons and Whitemore, Inc.) p 205–218 refs (See N70-14517 04-15)

14. SPACE HEATING IN URBAN ENVIRONMENTS A. J. Miller (Oak Ridge Natl. Lab., Tenn.) p 219–237 refs (See N70-14518 04-22)

15. APPLICATION OF LOW-COST ENERGY TO PROCESSING OF SEWAGE WATER FOR REUSE I. Spiewak (Oak Ridge Natl. Lab., Tenn.) p 239–247 refs (See N70-14519 04-11)

16. MARINE CHEMICAL RECOVERY W. C. Yee (Oak Ridge Natl. Lab., Tenn.) p 249–268 refs (See N70-14520 04-06)

17. POTABLE WATER FROM SEAWATER BY HIGH-TEMPERATURE ELECTRODIALYSIS W. A. Mc Rae (Ionics, Inc.) p 269–298 refs (See N70-14521 04-06)

18. NUCLEAR DESALTING C. C. Burwell (Oak Ridge Natl. Lab., Tenn.) p 299–312 refs (See N70-14522 04-24)

N70-14505# Oak Ridge National Lab., Tenn.
RATIONALE FOR LOW COST NUCLEAR HEAT AND ELECTRICITY
James A. Lane *In* AEC Abundant Nucl. Energy May 1969 p 3–28 refs (See N70-14504 04-22)
Avail: CFSTI

It is projected that the average delivered cost of electricity in the United States will decrease to 3.5 mills/kw-hr and the per capita consumption will increase to 30,000 kw-hr per annum in 2000 AD. Achieving such low-cost power will require significant improvements in generating costs, as well as reductions in transmission and distribution costs. Details of how this might be done are described. Generating costs, for example, will be reduced to about 1.5 mills/kw-hr through the development of very large (i.e., 5000-Mw(e)) high-performance breeders served by large-scale fabrication and processing plants. If the sale price of electricity is properly assigned to various types of customers as a function to the amount used by each customer, an average delivered price of 3.5 mills/kw-hr would result in a rate of 5.5 mills/kw-hr for residences and 1.5 mills/kw-hr for industries. Author (NSA)

N70-14506# Oak Ridge National Lab., Tenn.
ENERGY INTENSIVE AND HEAT INTENSIVE PROCESSES FOR A NUCLEAR ENERGY CENTER
John M. Holmes *In* AEC Abundant Nucl. Energy May 1969 p 29–43 refs (See N70-14504 04-22)
Avail: CFSTI

Chemical and metallurgical industries are large energy consumers with increasing power demands and significant sensitivities to changes in electricity prices. The major categories considered for installation at nuclear energy centers include: balanced fertilizers; metals, such as aluminum, iron, steel, and magnesium; plastics; and brine chemicals. Other energy-intensive systems that may show promise include waste-water treatment, electric railways, high-temperature process heating, urban space heating, and several recently developed electroorganic processes. For economic utilization of the power from a 1000-Mw(e) nuclear reactor, a number of the proposed systems would have to be combined into a complex. Author (NSA)

N70-14507# Tennessee Valley Authority, Muscle Shoals, Ala. Chemical Development Div.
PHOSPHORUS
M. M. Striplin, Jr. *In* AEC Abundant Nucl. Energy May 1969 p 47–66 refs (See N70-14504 04-22)
Avail: CFSTI

The lower cost of nuclear power and the higher price of sulfur are causing an increased interest in electric-furnace phosphorus. Advantages of phosphorus over wet-process phosphoric acid are higher concentration, greater usefulness, and ease of handling. The economy and mobility of nuclear power should encourage the production of more phosphorus from low-grade rock at the mines. Author (NSA)

N70-14508# Hooker Chemical Corp., Los Angeles, Calif.
EFFECT OF LOW-COST NUCLEAR ENERGY ON THE CHLORINE CAUSTIC INDUSTRY
John E. Currey *In* AEC Abundant Nucl. Energy May 1969 p 67–81 refs (See N70-14504 04-22)
Avail: CFSTI

The long-term effect on the chlorine–alkali industry of low-cost nuclear power is reviewed and arguments for including a chlorine plant in a nuclear-powered agro-industrial complex are presented. Nuclear reactors of the future and their low-cost power may make possible a choice of site locations not available in the past; manufacturing costs of chlorine and caustic will decrease. The plants in large industrial and agro-industrial complexes can be used to produce hydorchloric acid to treat the feed to desalination plants producing fresh water. Author (NSA)

N70-14512# Tennessee Valley Authority, Muscle Shoals, Ala.
PRODUCTION OF AMMONIA USING LOW-COST NUCLEAR ENERGY
Glenn M. Blouin *In* AEC Abundant Nucl. Energy May 1969 p 123–134 refs (See N70-14504 04-22)
Avail: CFSTI

It is postulated that expected near-term (10-yr) advances in nuclear electrical power stations and in hydrogen electrolysis cells will reduce costs to the point where electrolytic ammonia will be competitive in areas where conventional hydrocarbon feedstocks must be imported. Furthermore, far-term (20-yr) advances in reactor and electrolysis-cell technology could result in significant economic advantages over conventional ammonia processes. Author (NSA)

N70-14518# Oak Ridge National Lab., Tenn.
SPACE HEATING IN URBAN ENVIRONMENTS
A. J. Miller *In* AEC Abundant Nucl. Energy May 1969 p 219–237 refs (See N70-14504 04-15)
Avail: CFSTI

A preliminary study indicates that in 1980 the heat from a nuclear energy center in or near a large city could be used to heat and to air-condition a large portion of the city at a cost per unit of heat equivalent to that now incurred by district heating in downtown commerical and high-rise apartment areas. The heat used would be from steam out of back-pressure turbines and turbine bleed rather than from prime steam, and thus the waste of heat from the plant generating electricity would be reduced or largely eliminated. Such a system would reduce both chemical pollution of the air and thermal pollution of streams. Author (NSA)

N70-14577# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF TEMPERATURE FIELD OF HEAT-PRODUCING ELEMENTS OF THE CORE AND SHIELD OF THE BN-350 REACTOR ON EXPERIMENTAL MODELS
V. I. Subbotin et al 12 May 1969 24 p Transl. into ENGLISH from Fiz.-Energ. Inst. (USSR), 1965 p 1–22
(AD-695907; FTD-MT-24-70-69) Avail: CFSTI CSCL 18/11

The distribution of temperatures in various parts of a 350 Mw fast-neutron sodium-cooled reactor was investigated by means of two special experimental models. The first model consisting of two loops was similar to the core of the BN-reactor while the second model was arranged for investigation of heat transfer in the shielding area. Particular attention was given to the centrally and

peripherally located fuel elements, that is, to the fuel assemblies submitted to different heat transfer conditions. The core primary loop was cooled by sodium while a sodium-potassium compound was used as coolant for the secondary core loop as well as for fuel elements placed within lateral shields. A detailed description of the experiments was given and the results were analyzed. The irregularities in temperature distribution were graphically presented in 10 figures. Introductory information is also given on BN-350 reactor as well as on some heat transfer problems. TAB

N70-14584# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
REACTOR PRIMARY COOLANT SYSTEM RUPTURE STUDY Quarterly Progress Report, Jan. - Mar. 1969
Apr. 1969 88 p
(Contract AT(04-3)-189)
(GEAP-10024; QPR-16) Avail: CFSTI

Failure-causing mechanisms in reactor systems piping are studied in order to improve the reliability of these systems and increase design evaluation and analysis capability. Tasks reported on during this period include: reliability engineering, stress analysis, fracture mechanics, fatigue, and the effect of the BWR environment, with emphasis on chromium alloys and systems, ASTM A-106B steel and stainless steel, and molybdenum alloys and systems. M.H.E.

N70-14813# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
THE EFFECTS OF LAYERED COATINGS ON NUCLEAR FUEL PARTICLES ON MODULUS OF ELASTICITY DETERMINATION FOR THE OUTER LAYER HORIZONTAL TO THE SURFACE [DER EINFLUSS DES AUFBAUS BESCHICHTER KERNBRENNSTOFFTEILCHEN AUF DIE BESTIMMUNG DES ELASTIZITAETSMODULS DER AEUSSEREN SCHICHT SENKRECHT ZUR OBERFLAECHE]
K. Drittler Jul. 1969 30 p refs In GERMAN
(JUEL-605-RW) Avail: CFSTI

Developed is a formula that makes it possible to determine the modulus of elasticity in the outer layer of nuclear fuel particles coated with multiple layers of differing materials from pressure tests. Inner layers have only to be considered if simple measuring equipment is used on particles with an intermediate layer of silicon carbide. For particles with only one intermediate layer and an uniform outer layer, the formula for a sphere can be used to approximate the properties of the outer layer. Transl. by G.G.

N70-15073# Naval Research Lab., Washington, D.C.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, 1 May - 31 Jul. 1969
L. E. Steele, C. Z. Serpan, Jr., R. A. Gray, Jr., H. E. Watson, and F. A. Smidt Aug. 1969 48 p refs Sponsored in part by AEC
(AD-695371; NRL-MR-2027) Avail: CFSTI CSCL 18/10

The report, covering research for the period 1 May - 31 July 1969, includes the following: (1) irradiation response of A543 steel to different thermal/fast neutron fluxes, (2) mechanical property and neutron spectrum analyses of the Big Rock Point Reactor pressure vessel, (3) Charpy-V notch characteristics of irradiated A350-LF2 and A537-B weldments for prestressed concrete liner applications, (4) an analysis of fracture surface microstructure of radiation sensitive steels by scanning electron microscopy, (5) the initial assessment of 550F radiation embrittlement sensitivity of a special A533-B Class 1 electroslag weldment, and (6) mechanical properties assessments of thick section plates from low residual A533-B special heat. Author (TAB)

N70-15098 Pennsylvania State Univ., University Park.
LOCALIZATION OF IN-CORE DISTURBANCES WITH EXTERNAL CORE DETECTORS
Frank Joseph Saloh (Ph.D. Thesis) 1968 111 p
Avail: Univ. Microfilms: HC $5.60; Microfilm $3.00 Order No. 69-5530

An artificial periodic disturbance placed inside the core made it possible to initiate a recognizable signal at a specific location. The gamma rays from that location were selected by the collimator system. These gamma rays were detected by observing the light they produced upon interacting in a liquid scintillator. The statistically fluctuating light was analyzed on a specially programmed computer. When power spectral density measurements were made with the line of sight of the collimators aligned with the disturbance, a resonance occurred at the disturber frequency. As the collimator moved away from the disturbance, the resonance vanished. Thus the disturbance was located when the maximum resonance occurred. Information concerning the disturbance was also obtained using an incore neutron chamber. The results of these measurements confirmed ideas about the nature of the disturbance and led to an understanding of a phasing effect occurring between elements because of the disturber design. Dissert. Abstr.

N70-15145 Texas Univ., Austin.
INVESTIGATIONS ON THE MACROSCOPIC NODAL APPROACH TO SPACE-DEPENDENT NUCLEAR REACTOR KINETICS
Michael Gail Stevenson (Ph.D. Thesis) 1968 219 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-6221

The analysis of the space- and time-dependence of the neutron population in large nuclear reactor systems plays an important role in determining the controllability and safety of such systems. Several analytical and numerical methods were developed and used for calculating the transient behavior of reactors in which the space- and time-dependence is nonseparable. The most useful of these are reviewed, and one, the macroscopic nodal approach, is examined in detail, particularly with regard to the approximations involved. In addition, the fission mode method is developed; this is a consistent formulation based on the separability of partial fluxes due to nodal fission sources. To evaluate the validity and usefulness of the nodal methods, comparisons are made of numerical calculations of the transient behavior of two reference reactor systems expected to show space-dependent kinetics effects. These two systems are a large thermal reactor representative of present-generation power reactors, and a modular fast-breeder reactor system. Dissert. Abstr.

N70-15159 Northwestern Univ., Evanston, Ill.
CREEP RATCHETING IN NUCLEAR REACTOR FUEL ELEMENTS
Russell Charles Hibbeler (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-6936

The cladding of a sealed reactor fuel element, under the influence of internal pressure and a sufficiently high temperature gradient, may deform due to internal stress relaxation caused by creep. When the temperature gradient across the clad wall is cycled due to power change requirements of the reactor, the creep strains developed in the cladding may cause ratchetting or progressive growth of the fuel element in both the radial and axial directions. Assuming elastic stress interaction, a simple uniaxial stress model of the fuel element is developed, and the equations which determine the solution of the problem are presented. The flexibility of the analysis allows the engineer to include the effects of an arbitrary temperature cycle time and temperature dependence of material properties. Furthermore, the variation of external loading caused by fuel swelling and fission gas release is taken into account. Dissert. Abstr.

N70-15192 Carnegie-Mellon Univ., Pittsburgh, Pa.
A STOCHASTIC MODEL OF A TWO REGION NUCLEAR POWER REACTOR WITH XENON: STATIONARITY AND STABILITY

Val Prescop (Ph.D. Thesis) 1968 223 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 69-6586

The model is developed from the basic probability balance describing events of interest, including neutron, iodine, and xenon formation and loss, as well as control events, which enable numerical requirements on the control parameters for stationarity of the stochastic process to be established. The probability balance is transformed to the forward stochastic equation, and the first and second moment equations extracted. A general probability distribution, as represented by a skew term, is included in the moment equations. Qualitative arguments for the use of the normal approximation are presented, and the effect of a highly skewed neutron distribution around the mean neutron number is demonstrated. The values of variances and covariances are calculated from the first and second moment equations, using an iterative procedure, with the use of a digital computer. Dissert. Abstr.

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-14225# Indiana Univ., Bloomington. Dept. of Physics.
CALCULATION OF THE PENETRATION DEPTH AND ELECTROMAGNETIC ABSORPTION EDGE FOR STRONG-COUPLING SUPERCONDUCTORS
James C. Swihart and William Shaw [1969] 24 p refs Sponsored in part by NSF
Avail: CFSTI

The electromagnetic response function for various cases for a model of lead, both for the pure metal and a dilute nonmagnetic alloy, and both for the weak-coupling and strong coupling theories using Nam's theory was calculated. With these results, the low frequency penetration depth and the high frequency surface resistance in the neighborhood of the gap edge for these various cases was also calculated. A penetration depth for strong coupling pure lead of 406 A in better agreement with the experimental result of 390 A than previous calculations was found. The calculated absorption edge is steeper for the strong coupling theory than for the weak coupling theory and also is in good agreement with previous experimental results. The alloy calculation has a slightly steeper absorption edge than the calculation for the pure metal. Author

N70-14334# Southampton Univ. (England). Inst. of Sound and Vibration Research.
A COMPUTATIONAL STUDY OF ROTATIONAL NOISE
S. E. Wright and H. K. Tanna May 1969 151 p refs
(ISVR-TR-15) Avail: CFSTI

This report gives in graphical form the computed output of an extensive computational study of rotational noise. The computation covers the properties of blade loading harmonic radiation for a wide range of rotor parameters, including near field, distributed loading both chord and span, and for tip speed in excess of Mach one. The investigation then considers composite blade loading radiation, both simple and compound. Finally the radiation is computed for an ensemble of blade loading harmonics corresponding to well-defined blade loading azimuth functions, similar to those produced by blade slap and rotor/stator interactions. The study although designed for a particular rotor (helicopter), has sufficient scope to cover geometries of other rotor configurations. Author

N70-14360# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REPRODUCTION OF ELECTRICAL ULTRA-LOW FREQUENCY SIGNALS FROM A MAGNETIC TAPE
A. I. Naidenov 31 Jan. 1969 9p Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 4, 1964 p 9 10
(AD-694807; FTD-HT-23-730-68) Avail: CFSTI CSCL 20/1

The document discusses the means for reproducing electrical ultra-low frequency signals from a magnetic tape which make it possible to use ordinary recording devices for the registration of these signals without difficulties, and to use ordinary electromagnetic heads for their reproduction. The use of electrical modulation techniques is considered, permitting the use of ordinary magnetic recorders with rather weak specifications for the reproduction of electrical ultra-low frequency signals. Author (TAB)

N70-14467# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPLEX SCATTERING OF LIGHT IN TURBID MEDIA, CHAPTERS 1 AND 2
V. A. Timofeyev 17 Jun. 1969 42 p refs Transl. into ENGLISH from Tr. Morsk. Gidrofiz. Inst. Akad. Nauk SSSR (Moscow), no. 3, 1953 p 35–81
(AD-695946; FTD-MT-24-33-69) Avail: CFSTI CSCL 20/6

The purpose of the work is a study of diffusion of light in those media in which it is impossible to disregard multiple light scattering. The solution of this problem is of interest to scientists and also in the practice of diverse fields of knowledge: atmospheric optics and optics of the sea, astrophysics, lighting engineering, densitometry, hydrobiology, and others. Author (TAB)

N70-14500# Army Foreign Science and Technology Center, Washington, D.C.
CHARACTERISTICS OF RADIATION PROPAGATION THROUGH A FIBER-OPTIC ELEMENT
D. K. Sattarov 11 Sep. 1969 16 p refs Transl. into ENGLISH FROM Optiko-Mekh. Prom. (Leningrad), v. 35, no. 6, 1968 p 18–24
(AD-694581; FSTC-HT-23-413-69) Avail: CFSTI CSCL 20/6

The propagation of radiation in a fiber-optic element has been studied. It is shown that radiation is split into six components, each having its own specific aperture characteristics when emerging from the element. Light diffusion at the exit of the element is determined from calculation of the aperture characteristics of the individual components. Theoretical conclusions are confirmed experimentally. TAB

N70-14524*# Baganoff Associates, Inc., St. Louis, Mo.
DEVELOPMENT OF FULL IN-FLIGHT ACOUSTIC DESIGN CRITERIA SCALING EFFECTS Final Report, 29 Jun. 1968–29 Jun. 1969
Frederick Baganoff 27 Jun. 1969 172 p
(Contract NAS8-21461)
(NASA-CR-102411; Rept-507) Avail: CFSTI CSCL 20A

Developments in the methods of scaling fluctuating pressure environments for high performance aerospace vehicles are reported. Statistical results in the forms of transformed cross power spectral densities and directly reduced cross correlations are presented for three ramp angles and Mach nos. The experimental curves are utilized to support analytical developments relating to the reduction and interpretation of the microphone data. Equations are discussed that approximate the functional forms of the normalized cross correlation functions in the attached and separated flow regions. Author

N70-14543# Oak Ridge National Lab., Tenn.
MAGNETICS AND SUPERCONDUCTIVITY
K. R. Efferson, W. F. Gauster, J. B. Hendricks, D. M. Kroeger, M. S. Lubell et al *In its* Thermonuclear Div. Jun. 1969 p 182–202

refs (See N70-14532 04-25)
(NASA Order H-29278A)
Avail: CFSTI

The following topics are described: (1) review of ORNL super-conductivity research, (2) steady-state stability of composite superconductors, (3) winding techniques for superconducting magnets, (4) liquid helium level detector, and (5) progress on the IMP facility. NSA

N70-14586# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
PRELIMINARY REPORT ON THE LOADING SEEN BY A SINGLE MASSA TR-11 C SHAKER BOX
Sviatoslav Liapunov Apr. 1969 104 p refs
(Contract Nonr-266(84))
(AD-695797; CU-202-69-ONR-266-Phys; TR-174) Avail: CFSTI CSCL 20/1

The in-water loading acquired by a reflector-backed shaker box transducer is a measure of the reflective effectiveness of the reflector. A reflector-backed Massa TR-11C shaker box transducer was tested at sea under various operating conditions. The obtained measurements were used to determine the loadings seen by the transducer in all of these different cases. Author (TAB)

N70-14640# California Univ., Los Angeles. Dept. of Electrical Sciences and Engineering.
STUDY OF SCATTERING OF WAVES BY PENETRABLE OBJECTS Semiannual Progress Report, 1 Feb. - 31 Aug. 1969
C. Yeh Sep. 1969 13 p refs
(Contract N00014-67-A-0111-0014)
(AD-694036; SAPR-69-55) Avail: CFSTI CSCL 20/1

Progress on the following five problems is reported: Focusing by liquid elliptical line; Radial and angular mathieu functions; Acoustic imaging by holography; Scattering by arbitrarily shaped penetrable obstacles; Diffraction of sound waves by moving bodies. Author (TAB)

N70-14718# California Univ., Berkeley.
A NOTE ON DIPOLAR INERTIA
P. M. Naghdi and A. E. Green 1969 5 p refs Prepared in cooperation with Oxford Univ.
(Contract N00014-67-A-0114)
(AD-695959) Avail: CFSTI CSCL 20/4

A suitable expression is obtained for dipolar inertia, with reference to the spatial form of the kinetic energy in the theory of simple dipolar continuum mechanics. This includes the case in which the coefficient of the kinetic energy due to velocity gradient (in spatial form) may be constant. TAB

N70-14867# California Univ., Los Angeles. Dept. of Electrical Engineering.
ACOUSTIC IMAGING BY HOLOGRAPHY
Richard B. Mac Anally and C. Yeh Aug. 1969 258 p refs Sponsored in part by US Steel Found. and Hoffman Electron. Corp.
(Contract N00014-67-A-0111-0014)
(AD-694035; TR-69-48) Avail: CFSTI CSCL 20/1

A method for visualizing objects immersed in water is formulated analytically and demonstrated experimentally. The technique, called acoustic holography, is an adaptation of Gabors two-step imaging process known as wavefront reconstruction or holography. The hologram is first formed from coherent acoustic radiation and then the image is reconstructed optically using coherent light source. Acoustic holography has advantage over other schemes for imaging in optically opaque media in that lenses or other focusing devices are not required, and a complete amplitude and phase reconstruction of the scattered field may be obtained. Since instantaneous amplitude is an acoustic observable, the reference field may be simulated electronically. Moreover, by resorting to heterodyne or phase detection the cross product term between object and reference signals may be generated without the undesired extraneous terms which occur in conventional holography. A scanning technique for generating acoustic holograms of underwater objects in the laboratory is described in detail. Using this system acoustic holograms have been recorded which show angular resolution of 3.6 milliradians, approximately 1.5 times the Rayleigh limit. A variable contrast television display was used to view the acoustic holograms. Author (TAB)

N70-14924# McGill Univ., Montreal (Quebec). Magnet Lab.
HIGH PRESSURE EXPERIMENTS, HIGH FIELD RESEARCH, AND MAGNET TECHNOLOGY Final Report
Richard Stevenson Aug. 1969 8 p refs
(Contract Nonr-3013(00))
(AD-695004) Avail: CFSTI CSCL 20/12

The general theme of this research has been the experimental study of the magnetic properties of insulators, particularly in the attempt to study the interactions between magnetic atoms. The work divides itself into three parts: (a) experiments involving high pressure techniques, (b) experiments on magnetic properties usually involving high magnetic fields, (c) development of high magnetic field equipment. Author (TAB)

N70-14962# Ohio Univ., Athens. Dept. of Physics.
RADIATION IMPEDANCE OF A SMALL TRANSDUCER AT A WATER SURFACE NEAR PLANE BOUNDARIES
Folden B. Stumpf and Yan Y. Lan 15 Oct. 1969 51 p refs
(Contract N00140-69-C-0103)
(AD-695084) Avail: CFSTI CSCL 9/1

The purpose of the research reported here is to measure the radiation resistance of a small transducer placed at an air-water surface and near various combinations of plane boundaries and then obtain a theoretical model to fit the data. Since Sherman has shown that a small radiator at an air-water surface behaves like a dipole in an infinite medium one is encouraged to propose this as the acoustic source to explain the measurements. When a dipole-image model is used to fit the experimental results for the transducer near the various boundary combinations, good agreement is obtained. Author (TAB)

N70-14963*# Franklin Inst., Philadelphia, Pa. Research Labs.
A MONOGRAPH ON MAGNETIC FIELDS FOR LIFE SCIENTISTS, VOLUME 2
R. J. Gibson 1969 154 p refs
(Contract NSR-39-005-018)
(NASA-CR-107483; A-B2299-3-Vol-2) Avail: CFSTI CSCL 20C

This report is a general compilation of materials related to magnetobiology. Topics discussed include the dimensions and unit systems of the magnetic quantities, fundamentals of magnetic fields and the design of air core coils for producing magnetic fields, permanent magnet assemblies for producing magnetic fields, the earth as a permanent magnet, the design of shields to reduce magnetic fields, and the measurement of magnetic fields and instrumentation required. R.B.

N70-14998# Miami Univ., Fla. Inst. of Marine Science.
AMBIENT NOISE STUDIES: BIMINI, BAHAMAS, 1967 - 1968 Final Report, 1 Nov. 1967 - 31 Oct. 1968
Harry A. De Ferrari and W. C. Green Dec. 1968 69 p refs
(Contract N00024-68-C-1075)
(AD-694038; ML-69068) Avail: CFSTI CSCL 20/1

During a 72 day period, 18 February to 2 May 1967, ambient noise and in situ environmental parameters were sampled at 12 minute intervals off the coast of Bimini, Bahamas. The resulting time series were analyzed by spectral and cross spectral methods. There was no significant correlation between noise data at frequencies of 25 and 100 Hz, with wind speed up to 28 knots or wave height up to 6 feet. At frequencies of 400 and 1600 Hz, the ambient noise levels shows a strong correlation with wind

speed and wave height. Wind speed is shown to be the predominant factor and wave height is secondary in the production of higher frequency noise. Wave height is found to be strongly correlated to wind speed and current and temperature measurements exhibit some weak correlation with wind speed for low frequency fluctuations, i.e., below three days. High frequency periodicities of 8, 6, 4.8, 4 and 3 hours were found in the 400 and 1600 Hz records. These are thought to be harmonics of the 24 hour occurrence of a large rise in ambient noise level occurring at 2100 hours, which is produced by biological sources of unknown origin.
Author (TAB)

N70-15156# National Research Council of Canada, Ottawa (Ontario). Translations Section.
GALVANOMAGNETIC PROPERTIES OF SOLID SOLUTIONS OF BISMUTH-ANTIMONY
A. A. Kuliev et al 1969 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Tekhn. i Mat. Nauk (Baku), no. 3–4, 1967 p 17–24
(NRC-TT-1386) Avail: CFSTI

Measurements were carried out on monocrystals of solid Bi-Sb solutions obtained by pulling from the melt. Crystallographic directions were determined by cleavage planes and X-ray pictures. The Hall coefficient was measured in weak magnetic fields in directions corresponding to two independent tensor components. The quadratic portions of their dependence on the magnetoresistant field were observed. A system of equations consisting of six relations was solved using the selection method. The values obtained for mobilities of current carriers in solid solutions of Bi-Sb (using pure Bi) were compared. Hole and electron conductivity components were calculated from the values of partial mobilities and current carrier concentration. Valence and mobility zone overlapping and energy gap width during slit formation between zones were determined.
J.A.M.

N70-15215# Royal Radar Establishment, Malvern (England).
GALVANOMAGNETIC MODULAR CONSTRUCTIONS
H. Weiss [1967] 15 p refs Transl. into ENGLISH from Festkoerperprobleme (Braunschweig), No. 7, 1967 p 200–216
(RRE-Trans-186; TIL/OT/9040) Avail: CFSTI

Homogeneous semiconductors were considered in contrast to transistors and diodes with p-n junctions in which lifetimes, diffusion, and surfaces play an important role. These effects were omitted in galvanomagnetic modular constructions by using a majority carrier. Hall effect applications are reviewed.
Author

N70-15389*# Computing Devices of Canada, Ltd., Ottawa (Ontario).
METEOROID IMPACT FLASH ANALYZER Final Report
B. Jean and H. Henshaw 10 Dec. 1969 118 p refs
(Contract NAS9-8788)
(NASA-CR-102057; R134/FRI) Avail: CFSTI CSCL 20C

The conclusions of a research program aimed at the determination of micrometeoroid mass, velocity, and composition from its impact flash signature are presented. The radiation emitted in the impact flash was spectroscopically analyzed by a cluster of four photomultipliers monitoring the impact flash through four narrow band interference filters. With the meteoroid impact flash analyzer, the intensity and rate of change of intensity was studied for projectiles of two different meteoritic materials, at different velocities, diameters, and shapes. Experiments were conducted on Canyon Diablo iron and Bruderheim stone to develop the capability of identification of specific elements present in the projectile, from the experimental observation of their spectral emission at specific wavelengths. The results obtained from a cluster of five photomultipliers monitoring five narrow spectral bands, demonstrated that a measurement of the signal amplitude cannot be used for element identification. However, the possibility of obtaining the sought information from an integrated signal is excellent.
Author

N70-15398 Mississippi Univ., University.
SOUND VELOCITY AND ABSORPTION IN GASES AT REDUCED PRESSURES
Jerry S. Faughn (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/ Microfilm $3.00 Order No. 69-3960

A numerical solution of the Kirchhoff equation for the propagation constant of longitudinal sound waves in infinitely long cylindrical tubes was obtained which includes the boundary conditions of molecular slip and a finite temperature discontinuity at the tube wall. Sound velocity and absorption measurements were made in argon, neon, and nitrogen at reduced pressures where the molecular slip and temperature jump phenomena should play an important role. The results obtained are found to be in agreement with the numerical calculation. The independence of the velocity and absorption from tube properties such as density, specific heat and thermal conductivity are verified by measurements in brass and stainless steel tubes. Also, measurements made in neon confined to stainless steel and teflon coated stainless steel indicate that the fraction of molecules diffusely reflected from the tube surface is unity.
Dissert. Abstr.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-14125# Pennsylvania Univ., Philadelphia.
PRODUCTION OF BOSON RESONANCES IN THE REACTION P PLUS D YIELDS HE-3 PLUS X(O) USING A NOVEL MISSING-MASS SPECTROMETER
B. Maglic (Rutgers—The State Univ.), J. Norem (Rutgers—The State Univ.), J. Oostens (Rutgers—The State Univ.), R. Schluter (Argonne Natl. Lab.), and G. Cvijanovich (Uppsala Univ.) Aug. 1969 12 p refs Sponsored in part by AEC and NSF
(NYO-2171-286) Avail: CFSTI

A missing mass spectrometer which uses a magnet bending particles vertically and simultaneously focussing them horizontally with the fringe field, has been set up at the Princeton–Pennsylvania Accelerator. The spectrometer operates at the maximum (Jacobian) angle for the He3 particles from the reaction. Using this instrument, the neutral boson spectra of I = 0 and 1 are being investigated over the range from 0 to 1150 MeV. The pi meson, eta meson (O), and omega meson (O) as well as a shoulder near 300 MeV have been observed.
Author (NSA)

N70-14179# Institut Interuniversitaire des Sciences Nucleaires, Brussels (Belgium).
WEAK INTERACTIONS
Fr. G. Lannoy and J. Nuyts Sep. 1968 80 p refs In FRENCH
(NP-17984) Avail: AEC Depository Libraries

The generalities of spontaneous decay are described. The mean lifetimes of the fundamental particles, their observed decay modes and branching ratios are given. The principle results are collected in tables and include experimental results from the fall of 1968. The Fermi universal interaction law and selection rules are also discussed.
NSA

N70-14203# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONTRIBUTION TO THE FATHERLAND'S ELECTRONIC INDUSTRY
Hsien Feng 10 Feb. 1969 8 p Transl. into ENGLISH from Chung Kuo Hsin Wen, (Mainland), no. 5040, 1968 p 9–10

(AD-694749; FTD-HT-23-571-68) Avail: CFSTI CSCL 20/7

The Hsien Feng Electrical Machinery Plant in Shanghai recently produced a multiple electron cavity for use in electrostatic accelerators being used in Chinas nuclear research program. The new cavity has a service life four times greater than that of the old type and eliminates the need for tedious, time-consuming periodic cavity replacements and enables Chinese electrostatic electron accelerators to meet international quality standards. Author (TAB)

N70-14216*# Aztec School of Languages, Inc., Maynard, Mass.
ENERGY DISTRIBUTION IN THE BEAM OF AN ELECTRON GUN WITH A SINGLE-CRYSTAL SPHERICAL CATHODE. A: INFLUENCES IN THE ACCELERATION REGIONS [DIE ENERGIEVERTEILUNG IM STRAHLENBUNDEL EINER ELEKTRONENKANONE MIT EINKRISTALLINER KUGELKATHODE]
K. J. Hanszen et al Washington NASA Dec. 1969 20 p refs Transl. into ENGLISH from Z. Naturforsch. (Tuebingen), Teil a, v. 24a, Feb. 1969 p 214–225
(Contract NASw-1692)
(NASA-TT-F-12559) Avail: CSFTI CSCL 20H

Discussion of a method for determining the influence of effects within an electron gun on the energy distribution of transmitted fractional beams, by placing a diaphragm with small perforations directly behind the anode. The effects of the work function, the space charge cloud, and the beam overlapping can be distinguished from one another, since these manifestations induce easily observed changes in the mean energy, half width, and distribution form. Very narrow energy distributions are observed near the cutoff point and in the so-called second hollow-beam region. Author

N70-14280# Atomic Energy Commission Research Establisment, Riso (Denmark). Reactor Physics Dept.
THE EFFECTIVE RESONANCE INTEGRAL OF U-238
Jorn Mikkelsen Mar. 1969 19 p refs
(Riso-M-865) Avail: CFSTI

The resonance integral of U-238 in homogeneous infinite mixtures has been expressed as a function of temperature and excess scattering. The formula is based on calculations, using the program RESAB, which includes the influence of scattering interference. For mixtures, containing UO2, the right slowing down kernel for 0 is incorporated. It is demonstrated, how the result can be used to calculate the resonance integral of U-metal rods and UO2 rods. A comparison with the measurements of E. Hellstrand et al. is carried out. The deviation is 1-3%. Author

N70-14282*+ Oak Ridge National Lab., Tenn. Neutron Physics Div.
CALCULATION OF THE NEUTRON AND PROTON SPECTRA FROM THICK TARGETS BOMBARDED BY 450-MEV PROTONS AND COMPARISON WITH EXPERIMENT
R. G. Alsmiller, Jr., J. W. Wachter, and H. S. Moran 6 Jan. 1969 29 p refs Submitted for publication
(NASA Order H-38280A)
(NASA-CR-107383; ORNL-TM-2462) Avail: CFSTI CSCL 20H

Nucleon–meson cascade calculations were carried out for 450-MeV protons incident on a variety of thick targets. The energy spectra of emitted neutrons and protons at specific angles are compared with experimental measurements. Author (NSA)

N70-14310# California Univ., Livermore. Lawrence Radiation Lab.
HAZARDS CONTROL Progress Report, Sep.–Dec. 1968
Dec. 1968 83 p refs Sponsored by AEC
(UCRL-50007-68-3; PR-32) Avail: CFSTI

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9. CONSTRUCTION OF AN UNDERGROUND WHOLE-BODY-COUNTER SHIELD R. V. Griffith and A. L. Anderson p 46–50 (See N70-14319 04-11)

10. GAS CHROMATOGRAPHIC ANALYSES FOR LOW CONCENTRATIONS OF FEFO E. N. Sanborn p 51–53 (See N70-14320 04-14)

11. RESULTS OF PARTICIPATION IN AN IAEA ENVIRONMENTAL SAMPLE INTERCOMPARISON R. V. Griffith p 53–58 (See N70-14321 04-24)

12. ENERGY DEPENDENCE CHARACTERISTICS OF THE NEW LRL PERSONNEL DOSIMETER B. G. Samardzich p 59–64 (See N70-14322 04-14)

N70-14312# California Univ., Livermore. Lawrence Radiation Lab.
DOSE RATES FROM A GAMMA-EXCITED FLUORESCENT X-RAY SOURCE
J. F. Tinney and J. V. Boggs *In its* Hazards Control Dec. 1968 p 5–11 Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

A gamma-excited fluorescent X-ray source is described. Theoretical calculations illustrate the range of dose rates that can be obtained with a back diffusion geometry. Results of dose-rate and relativity measurements for target materials Z = 22 to Z = 69 are also presented. Author (NSA)

N70-14313# California Univ., Livermore. Lawrence Radiation Lab.
REMOTE AREA MONITORING (RAM) ARRAYS FOR CLOSE-IN MONITORING DURING UNDERGROUND NUCLEAR TESTING
C. T. Prevo and B. L. Rich *In its* Hazards Control Dec. 1968 p 12–17 Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

A theoretical study is made of the lower limit of detectability and the accuracy of remote area monitoring (RAM) arrays for close-in monitoring during underground nuclear testing. Author (NSA)

N70-14315# California Univ., Livermore. Lawrence Radiation Lab.
MEASUREMENT OF THE NEUTRON SPECTRUM FROM THE LPTR FAST NEUTRON IRRADIATION FACILITY
R. V. Griffith *In its* Hazards Control Dec. 1968 p 21–25 Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

The measurement of the flux and integral spectrum of the fast neutron irradiation facility at the LPTR using a combination activation and fission foils is described. Author (NSA)

N70-14317# California Univ., Livermore. Lawrence Radiation Lab.
RADON DAUGHTER EQUILIBRIUM MEASUREMENTS IN URANIUM-MINE ATMOSPHERES
C. L. Lindeken *In its* Hazards Control Dec. 1968 p 34–38 refs Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

When radon gas formed for radioactive decay of uranium escapes from exposed ore surfaces and enters the mine atmosphere, a series of short-lived daughter products is formed and becomes a potential hazard to mine workers. In an unventilated mine or in a section of the mine that is poorly ventilated, these daughter products will accumulate and will approach equilibrium with radon. Various methods for measuring radon daughter equilibrium are discussed. A prototype plutonium alpha air monitor using a 450 sq mm surface-barrier silicon diode is described for determining this radon daughter equilibrium. Author (NSA)

N70-14321# California Univ., Livermore. Lawrence Radiation Lab.
RESULTS OF PARTICIPATION IN AN IAEA ENVIRONMENTAL SAMPLE INTERCOMPARISON
R. V. Griffith *In its* Hazards Control Dec. 1968 p 53–58 Sponsored by AEC (See N70-14310 04-24)
Avail: CFSTI

Results are presented from an IAEA environmental sample intercomparison measurements of the activities of Cs-137 and K-40 in animal material, K-40 in feldspar, Rn-222 in water, and Ra-226 and Ra-228 in soil. Author (NSA)

N70-14340# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Divisione Sicurezza e Controlli.
STORAGE SYSTEM FOR HIGH ACTIVITY LIQUID WASTES: PROJECT CRITERIA FOR SAFETY ANALYSIS [SISTEM DI IMMAGAZZINAMENTO DI RIFIUTI LIQUIDI AD ALTA ATTIVITA: CRITERI DI PROGETTO RELATIVI ALL'ANALISI DI SICUREZZA]
V. Pujia, C. Sennis, and R. Simonetta 1969 41 p refs In ITALIAN; ENGLISH summary
(RT/PROT/69/4) Avail: CFSTI

The storage systems of high activity liquid waste of the type used in Italian plants are taken into consideration. An analysis of the characteristic risks of these systems is performed; in particular tank corrosion, boiling of wastes, hydrogen-air mixture detonation, criticality excursions, earthquakes. Author

N70-14414# Kernforschungsanlage, Juelich (West Germany). Institut fuer Medizin.
GAMMA-SPECTRA FOR THE ELEMENTS APPEARING IN ORGANISM AFTER ACTIVATION WITH THERMAL (REACTOR) -NEUTRONS, TAKEN AFTER CONSTANT DECAY TIME [GAMMA-SPEKTREN DER IN ORGANISMUS VORKOMMENDEN ELEMENTE NACH AKTIVIERGUN MIT THERMISCHEN (REAKTOR)-NEUTRONEN, AUFGENOMMEN NACH KONSTANTEN ABKLINGZEITEN]
V. Siller and K. Kasperek Sep. 1968 362 p refs In GERMAN
(JUEL-559-ME) Avail: CFSTI

Obtained were elemental gamma-ray spectra and their constant decay times which encompass the sum of all radioisotope spectra developing during neutron irradiation of one element. Selected irradiation times covered also elements with short-lived radioisotopes. Obtained gamma spectra pertain only to those elements detectable in biological materials with emphasis on the elemental composition of adult men. Transl. by G.G.

N70-14415# Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung.
COMPARATIVE RESEARCH ON THE INFLUENCE OF VARIOUS CRYSTAL MODELS ON THE SCATTERING OF THERMAL NEUTRONS IN BERYLLIUM OXIDES WITH ASSISTANCE OF THE COLLI COMPUTER PROGRAM [EINE VERGLEICHENDE UNTERSUCHUNG UEBER DEN EINFLUSS VERSCHIEDENER KRISTALLMODELLE AUF DIE STREUUNG THERMISCHER NEUTRONEN IN BERYLLIUMOXYD MIT HILFE DES RECHENPROGRAMMS COLLI]
Guenter Schroeder Aug. 1969 129 p refs In GERMAN
(JUEL-610-RG) Avail: CFSTI

A computer program was used to evaluate the effects of phonon spectra from various crystal models on the scattering characteristics of the moderator beryllium oxide. The scattering law at a certain temperature was determined for each moderator and stored. Desired energy values were then obtained from stored data by integration of scattering matrices and thus eliminated new calculations on double differential scattering effect matrices. It was shown that a simple phonon spectrum model, developed from two atom linear chains, represented the scattering properties of beryllium oxide in good agreement with more complicated phonon spectrum models. The decisive factor was the selection of integral parameters in phonon spectrum calculations. Transl. by G.G.

N70-14429# American Nuclear Society, New York. Metropolitan Section.
CALIFORNIUM-252
James J. Barker, ed. Jan. 1969 388 p Symp. held at New York City, 22 Oct. 1968 Sponsored by AEC
(CONF-681032) Avail: CFSTI

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6. CALIFORNIUM-252 PRODUCTION AT OAK RIDGE NATIONAL LABORATORY J. E. Bigelow (Oak Ridge Natl. Lab., Tenn.) p 159–177 (See N70-14435 04-24)

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9. HEAVY ELEMENTS IN STARS J. R. Huizenga (Rochester Univ., N.Y.) p 213–223 refs (See N70-14438 04-24)

10. SURVEY OF APPLICATIONS FOR CALIFORNIUM-252 A'PLICATIO-S FOR CALIFOR-IUM-252 J. L. Crandall (Du Pont de Nemours (E. I.) and Co., Aiken p 225–256 refs See N70-14439 04-24)

11. NUCLEAR SAFEGUARDS APPLICATIONS OF CALIFORNIUM-252 G. R. Keepin and R. B. Walton (Los Alamos Scientific Lab., N.Mex.) p 257–275 refs (See N70-14440 04-24)

12. DOSIMETRY OF CALIFORNIUM-252 R. G. Fairchild (Brookhaven Natl. Lab.) p 277–284 refs (See N70-14441 04-24)

13. THE MEDICAL USE OF CALIFORNIUM-252 H. L. Atkins (Brookhaven Natl. Lab.) p 285–302 refs (See N70-14442 04-04)

14. FORSEEABLE APPLICATION OF CALIFONRIUM-252 TO NEUTRON RADIOGRAPHY J. P? Barton (Argonne Natl. Lab., 111) p 303–319 refs (See N70-14443 04-24)

15. USE OF CALIFORNIUM-252 FOR MINERAL EXPLORATION: COMPARISON WITH ACCELERATORS FOR IN SITU NEUTRON ACTIVATION OF SILVER F. E. Senftle, P. W. Philbin, and P. Sarigianis (Geological Survey) p 321–346 refs (See N70-14444 04-24)

16. THERMAL NEUTRON FLUX DISTRIBUTION FROM A CALIFORNIUM-252 SPONTANEOUS-FISSION NEUTRON SOURCE D. W. Magnuson (Union Carbide Corp., Oak Ridge, Tenn.) p 347–362 refs (See N70-14445 04-24)

N70-14430# Atomic Energy Commission, Washington, D.C.
CALIFORNIUM-252: RADIOISOTOPE WITH A FUTURE
Glenn T. Seaborg *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 1–9 Sponsored by AEC (See N70-14429 04-24) (S-38-68) Avail: CFSTI

The properties and uses of Cf-252 are described. Discovery of the isotope and methods of its production are reivewed. Medical applications of the isotope, its use in prospecting for important minerals and as a neutron source in research and teaching, and industrial applications are discussed. Analytical procedures using Cf-252 are considered. NSA

N70-14431# Argonne National Lab., Ill. Chemistry Div.
DISCOVERY AND HISTORY OF CALIFORNIUM-252
Paul R. Fields *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 11–21 refs Sponsored by AEC (See N70-14429 04-24)
Avail: CFSTI

The production of Cf-252 from the capture of 13 successive neutrons by Pu-239 in a reactor and a thermonuclear explosion is described. NSA

N70-14432# Brookhaven National Lab., Upton, N.Y. Neutron Cross Section Center.
NUCLEAR AND PHYSICAL PROPERTIES OF CALIFORNIUM-252
A. Prince *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 23–130 refs Sponsored by AEC (See N70-14429 04-24)
Avail: CFSTI

The nuclear and physical properties of Cf-252 are reviewed. The alpha decay scheme, spontaneous and neutron-induced fission, prompt and delayed neutron emission, neutron cross sections, and the nuclear charge distribution are discussed. NSA

N70-14434# Los Alamos Scientific Lab., N. Mex.
PRODUCTION OF CALIFORNIUM-252 IN THERMONUCLEAR EXPLOSIONS
George A. Cowan *In* Amer. Nucl. Soc. Californium-252 Jan 1969 p 151–157 refs Sponsored by AEC (See N70-14429 04-24)
Avail: CFSTI

Relative economics of fission reactor methods and the thermonuclear explosion method for the synthesis Cf-252 are considered. The initial target material in both cases is U-238. The nuclear reactions in the production processes and economic aspects of the thermonuclear method are discussed. NSA

N70-14435# Oak Ridge National Lab., Tenn. Chemical Technology Div.
CALIFORNIUM-252 PRODUCTION AT OAK RIDGE NATIONAL LABORATORY
John Ealy Bigelow *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 159–177 Sponsored by AEC (See N70-14429 04-24)
Avail: CFSTI

The High Flux Isotope Reactor (HFIR) and the Transuranium Processing (TRU) Plant are described. The TRU flow sheet for purification of the transplutonium elements produced in the HFIR is described. The Tramex process and a UCl anion-exchange method are used. NSA

N70-14436# Du Pont De Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
LARGE-SCALE PRODUCTION OF CALIFORNIUM-252: REACTOR IRRADIATION, CHEMICAL RECOVERY, AND SOURCE FABRICATION
J. A. Smith *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 179–200 refs Sponsored by AEC (See N70-14429 04-24) (Contract AT(07-2)-1)
Avail: CFSTI

In response to current indications of possible large-scale applications of Cf-252 Savannah River proposed a two-phase production program: make 2 to 3 grams for development of applications and provide kilograms per year for applications. The gram quantities can be made by irradiation of plutonium–americium–curium and encapsulation of sources in suitable material. Production of kg/yr is contingent upon supply of hundreds of kg/yr of Am-243 from power reactors and successful development of a reactor core designed for greater capacity of starting materials and lower losses to fission between Am-243 and Cf-252 relative to thermal reactors. Known alternative sources of supply and reactor design would produce californium at lower rates. Author (NSA)

N70-14437# Atomic Energy Commission, Washington, D.C. Div. Of Production.
DEVELOPMENT AND PRODUCTION OF CALIFORNIUM-252
Frank P. Baranowski *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 201–211 Sponsored by AEC (See N70-14429 04-24)
Avail: CFSTI

Plans for production of Cf-252 are considered and their economic aspects discussed. An AEC program for loan of Californium-252 neutron sources for research on applications is described. Forecasts of quantities of material, timing and prices are provided. NSA

N70-14438# Rochester Univ., N.Y. Nuclear Structure Research Lab.
HEAVY ELEMENTS IN STARS
John R. Huizenga *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 213–223 refs Sponsored by AEC (See N70-14429 04-24)
Avail: CFSTI

Theories of element formation in the stars are briefly reviewed and some of the evidence for heavy element formation in the stars is examined. The s and r processes are considered in some detail. Theories on the processes taking place in supernovae are mentioned. NSA

N70-14439# Du Pont De Nemours (E. I.) and Co., Aiken S.C. Savannah River Lab.
SURVEY OF APPLICATIONS FOR CALIFORNIUM-252
J. L. Crandall *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 225–256 refs Sponsored by AEC (See N70-14429 04-24)
Avail: CFSTI

Cf-252 has major potential in providing compact, portable, and reproducible neutron sources at intensities ranging from a few neutrons/second up to 10-14 neutrons/second. implants for cancer therapy, as point sources for neutron radiography, and as portable tools for mineral exploration, as well as meeting more specialized purposes such as reactor physics measurements. Other uses

of the Cf-252 sources are expected in such fields as activation analysis, short-lived radioisotope production, moisture gages, well logging, and in-line process instrumentation, where the operating simplicity, minimal maintenance, and full predictable output of these sources should open many applications which are currently closed to the more conventional accelerator and reactor sources. Particular emphasis is being placed on industrial uses of the Cf-252 sources for the in-line process control. A preliminary market survey of possible Cf-252 applications indicates a demand for 20 to 60 g of Cf-252 by 1975. Author (NSA)

N70-14440# Los Alamos Scientific Lab., N.Mex.
NUCLEAR SAFEGUARDS APPLICATIONS OF CALIFORNIUM-252
G. R. Keepin a2d R. B. Walton *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 257–275 refs Sponsored by AEC (See N70-14429 04-24)
Avail: CFSTI

Use of Cf-252 as a neutron source in nondestructive assay applications in nuclear safeguards technology and nuclear materials management is discussed. NSA

N70-14441# Brookhaven National Lab., Upton, N.Y. Medical Research Center.
DOSIMETRY OF CALIFORNIUM-252
R. G. Fairchild *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 277–284 refs Sponsored by AEC (See N70-14429 04-24)
Avail: CFSTI

In order to evaluate the effects of radiation on biological material, the absorbed dose to tissue must be measured. In this respect Df-252 presents a more difficult problem than conventional x rays or Co-60 irradiators, since it delivers a mixed field of radiation; about 37% of the absorbed dose to tissues is from gamma rays and 63% from fast neutrons. Since the biological response is different for each type of radiation, the absorbed dose from neutrons and gamma rays must be measured separately. Author (NSA)

N70-14443# Argonne National Lab., Ill. Metallurgy Div.
FORSEEABLE APPLICATION OF CALIFORNIUM-252 TO NEUTRON RADIOGRAPHY
J. P. Barton *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 303–319 refs Sponsored by AEC (See N70-14429 04-24)
Avail: CFSTI

The future demand for Cf-252 as a neutron source for radiography is evaluated. Applications for small-source neutron radiography include direct exposure to thermal neutrons, gamma insensitive exposure to thermal neutrons, and fast neutron radiography. The complementary and competitive uses of Cf-252 for neutron sources are discussed. NSA

N70-14444# Geological Survey, Washington, D.C.
USE OF CALIFORNIUM-252 FOR MINERAL EXPLORATION: COMPARISON WITH ACCELERATORS FOR IN SITU NEUTRON ACTIVATION OF SILVER
F. E. Senftle, P. W. Philbin, and P. Sarigianis *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 321–346 refs Sponsored in part by AEC (See N70-14429 04-24)
Avail: CFSTI

Techniques for using accelerators and californium-252 as neutron sources for in situ neutrons activation of silver ores followed by detection with a gamma ray spectrometer are described. Gamma spectra of similar silver ores are compared and the advantages and disadvantages of each type of neutron source are discussed. Cf-252 is particularly suitable for borehole exploration. Author (NSA)

N70-14445# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
THERMAL NEUTRON FLUX DISTRIBUTION FROM A CALIFORNIUM-252 SPONTANEOUS-FISSION NEUTRON SOURCE
D. W. Magnuson *In* Amer. Nucl. Soc. Californium-252 Jan. 1969 p 347–362 refs (See N70-14429 04-24)
(Contract W-7405-ENG-26)
(Y-DR-1) Avail: CFSTI

Measurements were made of the spatial distribution of the thermal neutron flux near a Cf-252 spontaneous-fission neutron source in water. A maximum value of 0.0132 thermal neutrons sq cm per source neutron was found near the source and the distribution was in excellent agreement with fluxes previously calculated using the ANISN code. The californium was dispersed in aluminum and sealed in an aluminum cylinder, 0.364 in. o.d. and 0.75 in. long. Author (NSA)

N70-14486# California Univ., Livermore. Lawrence Radiation Lab.
FEW-SPEED MODEL FOR THERMAL MODERATOR MOTION
Eugene H. Canfield Feb. 1969 3 p refs Presented at Am. Nucl. Soc. Ann. Meeting, Seattle, 15–19 Jun. 1969 Submitted for publication Sponsored by AEC
(UCRL-71645; CONF-690609-13) Avail: CFSTI

Hot Breit–Wigner cross sections were calculated using one-, two-, and three-speed models for thermal moderator motion. It was found that as the number of discrete speeds were increased the results rapidly approached those for a Maxwell distribution. NSA

N70-14494*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SEMICLASSICAL ELASTIC SCATTERING CROSS SECTIONS FOR A CENTRAL FIELD POTENTIAL FUNCTION
James R. Stallcop Washington 1969 299 p refs
(NASA-SP-3052) Avail: CFSTI CSCL 20H

The development and the application of the semiclassical scattering approximation are outlined. Partial scattering amplitude formulas that are not limited to the JWKB phase shifts are presented. The semiclassical approximation to the partial wave description of scattering in this report consists of: (1) the approximation of the phase shifts by the JWKB method, and (2) the evaluation of the scattering amplitude by the stationary phase method or other related approximate means. For a given energy, this semiclassical approximation is accurate when kr sub e is much greater than 1, where k is the wave number of the relative motion and r sub e is the scale of the interaction potential (r sub e difference 1A for atomic or molecular scattering). A uniform approximation to the phase shift for energies in the barrier region of the effective potential energy is developed by a WKB-type method; it is valid for all energies, regardless of whether they are near or far from the barrier maximum, and can be used to estimate the resonance contributions to the scattering which are not accounted for in the JWKB approximation. Author

N70-14522# Oak Ridge National Lab., Tenn.
NUCLEAR DESALTING
C. C. Burwell *In* AEC Abundant Nucl. Energy May 1969 p 299–312 refs (See N70-14504 04-22)
Avail: CFSTI

The multistage-flash (MSF) and vertical-tube evaporation (VTE) processes for desalting seawater are discussed briefly. The dual-purpose plant concept is described, and a comparison is made between alternative steam conditions used for the joint production of electricity and water. Previously reported cost projections for energy and desalted water are tabulated and compared with the cost of conveying natural fresh water from a water-rich region. Finally, consideration is given to the potential future application of desalted water to irrigation agriculture. Author (NSA)

N70-14541# Oak Ridge National Lab., Tenn.
ATOMIC AND MOLECULAR CROSS SECTIONS
C. F. Barnett, J. A. Ray, and Arnold Russek *In its* Thermonuclear Div. Jun. 1969 p 160–175 refs (See N70-14532 04-25)
Avail: CFSTI

The following topics are discussed: (1) highly excited Rydberg states of H2, (2) excitation heating of ions, (3) cross sections for hydrogen particles in magnesium vapor, (4) electrodisintegration of the deuteron, (5) photoionization of krypton between 300 and 1500 eV, (6) production of hydrogen atoms, (7) hydrogen atom energy analyzer, (8) evaluation of a magnetic shield of four nested cylinders, and (9) detector evaluations. NSA

N70-14581# Stanford Univ., Calif. High Energy Physics Lab.
GENERATION OF MECHANICAL VIBRATIONS BY PENETRATING PARTICLES
B. L. Beron and R. Hofstadter Jun. 1969 9 p refs
(Contracts Nonr-225(67); NSF GP-9498)
(AD-695420; HEPL-604) Avail: CFSTI CSCL 18/4

Mechanical, or sound, vibrations were observed in ceramic piezoelectric disks of lead-zirconate-titanate (PZT) struck by high energy electrons. Four 1/2 inch thick disks of PZT were used. A wide band, low impedence, common base configuration amplifier was used to examine the induced vibrations. Since the most prominent resonant frequencies of the disks were near 40 kHz (radial mode) and 158 kHz (compressional mode) most of the studies were concentrated on these modes. Electrons of energy 1.00 BeV and 0.20 BeV were used in pulses, each lasting about 1.0 microsecond and contained 10,000 to 1,000,000 to electrons. The cross section of the incident 1.00 BeV beam was about 3 mm x 3 mm. Author (TAB)

N70-14614# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
NEUTRON COUNTING AND BORON DETERMINATION BY DETECTION OF DE-EXCITATION GAMMA FROM THE LI-7 NUCLEUS PRODUCED BY THE REACTION B-10(n,ALPHA)LI-7
J. Laune Jul. 1968 6 p refs Transl. into ENGLISH from J. de Phys. et le Radium (France), v. 23, no. 4, 1962 p 238–240
(LB-G-2766) Avail: CFSTI

When irradiating boron-10 by slow neutrons, 93% of the 7Li nuclei formed are left in an excited state. The detection of the de-excitation of gamma ray may be applied for counting neutrons and for the determination of boron. Author

N70-14618# Arizona State Univ., Tempe. Dept. of Physics.
HEURISTICS OF ELECTRODYNAMIC QUANTUM THEORY Technical Progress Report, 1 Jul. – 31 Oct. 1969
David Hestenes Aug. 1969 47 p refs
(Contract N00014-68-A-0306-002)
(AD-694545; TPR-2) Avail: CFSTI CSCL 20/10

A new, physical interpretation of de Broglie waves is suggested. It is assumed that every elementary charged particle is the source, not only of a coulomb field, but also of a monochromatic radiation field with frequency determined by the de Broglie relation. On the basis of this single assumption, and with appeal only to general properties of electromagnetic fields, qualitative explanations are given for all the main features of quantum theory. Author (TAB)

N70-14619# Illinois Univ., Urbana. Coordinated Science Lab.
MULTIPLE-SCATTERING DESCRIPTION OF INTENSITY PROFILES OBSERVED IN LOW-ENERGY-ELECTRON DIFFRACTION FROM SOLIDS
C. B. Duke and C. W. Tucker, Jr. Sep. 1969 17 p refs
(Contract DAAB07-67-C-0199)
(AD-693795; R-431) Avail: CFSTI CSCL 20/12

The dependence on beam energy and lattice geometry of the intensity of electrons diffracted from surfaces is evaluated using the inelastic-collision model. At energies below that of the second primary Bragg peak, qualitative features of the intensity profiles are related to the lattice geometry. Their quantitative features depend sensitively on the scattering from the surface layer. The first detailed interpretation of such profiles is proposed for the (100) face of tungsten. Author (TAB)

N70-14691# Naval Research Lab., Washington, D.C. Nuclear Physics Div.
NRL VAN de GRAAFF OPERATION Interim Report, 1 Jan. – 30 Jun. 1969
K. L. Dunning Sep. 1969 39 p refs
(AD-694942; NRL-MR-2038) Avail: CFSTI CSCL 20/7

The report is a summary of the operation and use of the NRL 5-MV Van de Graaff accelerator and associated instruments for the period of 1 January to 30 June 1969. Brief accounts of the research and development projects under way are included. Author (TAB)

N70-14692# Naval Research Lab., Washington, D.C. Nuclear Physics Div.
NUCLEAR APPLICATIONS PROGRAM Progress Report, 1 Aug. 1968 – 30 Jun. 1969
E. A. Wolicki, ed. Sep. 1969 56 p refs
(AD-694950; NRL-MR-2039) Avail: CFSTI CSCL 20/12

A Nuclear Applications program was initiated in the Nuclear Physics Division in January of 1968 in order to foster the utilization of nuclear techniques for solving existing research problems in nonnuclear areas at NRL. In general the experiments performed under this program fall into two classes: (a) the analysis of materials using neutron or charged particle radioactivation or prompt radiation detection; and, (b) ion implantation of energetic heavy ions into solids. Research in materials analysis included investigation of both radioactivation and prompt radiation techniques. Radioactivation was performed with neutrons, and with high energy charged particles; prompt radiation detection included measurements on elastically scattered charged particles as well as on gamma rays. Ion implantation experiments were performed. Ions used at the Van de Graaff accelerator were He3, Ar40, Kr84 and Xe129. Ions used at the 30 kV system were B11 and Ar40, and ions used at the NBS isotope separator were Al27 and Cr52. Author (TAB)

N70-14733# Atomic Energy Commission, New York.
STRATOSPHERIC FALLOUT IN THE OCEANS OF THE NORTH TEMPERATE ZONE
I. L. Karol *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 75–105 refs (See N70-14726 04-04)
(A-AC-82/G/L-1249) Avail: CFSTI

Comparisons of the measured content of isotopes in soils and in vertical columns of seawater at the same latitudes and time showed that the Cs-137 and Sr-90 in the water columns were 3 to 6 times higher than the similar contents in soils. Therefore, a study was made of factors which affect the removal of radioactive aerosols, i.e., products of nuclear explosions, from the troposphere and their deposition onto the surface of the continents and oceans: A mathematical model developed for examining, qualitatively and quantitatively, the influence of physico-climatic mechanisms on the transport of stratospheric fallout by precipitation and dry deposition, is described. Results of calculations using this model indicate that global fallout onto continents and oceans in the same zone should be equal, and that more information on fallout mixing in the deep ocean layers must be obtained in order to explain the high fallout content measurements made in the near surface layer ocean water. NSA

N70-14734# Atomic Energy Commission, New York.
AN EXPONENTIAL SOURCE AS A MODEL OF RADIOACTIVE CONTAMINANTS
V. V. Pavlov et al *In its* USSR Rept. on Nat. and Fallout Radioact.

1 Feb. 1969 p 106–118 refs (See N70-14726 04-04)
(A-AC-82/G/L-1250) Avail: CFSTI

A description is given of the use of three dimensional mathematical models for estimating dose rates from radioactive substances in lower layers of soils based on the experimentally determined distribution of radioactive material in soil according to the relationship q=q sub ze(-kz) where q(z) is the volume density of the concentration of a radioactive isotope at depth z; and k is the constant of distribution of sources in the soil. The magnitude of k depends quite largely upon the type of soil and the age of the radioactive fallout. The method of computing the dose rate is illustrated, and the results plotted. NSA

N70-14737# Atomic Energy Commission, New York.
METHODS OF STUDYING THE BEHAVIOR OF RADIOSTRONTIUM IN SOILS OF DIFFERENT GEOCHEMICAL REGIONS
E. B. Tyuryukanova *In its* USSR Rept. on Nat. and Fallout Radioact. 1 Feb. 1969 p 134–144 refs (See N70-14726 04-04)
(A-AC-82/G/L-1253) Avail: CFSTI

The behavior of Sr-90 in soils of different regions is determined by many factors including: the place where it is produced; the manner and rate of entry; and the nature of the topographic–geochemical situation into which the isotope enters. Methods for evaluating the effects of these variables are presented. It is concluded that topographic–geochemical studies must precede any forecasting of the radiation situation for a particular locality, especially the distribution, migration, and formation of secondary foci of Sr-90 accumulation. NSA

N70-14768# Brookhaven National Lab., Upton, N.Y.
A TEN EXPERIMENT PERSPECTIVE VIEW OF AN ANALYSIS SYSTEM USING ROAD-GUIDANCE FSD'S
K. L. Abrams, P. L. Connolly, K. M. Crennell, D. J. Crennell, B. B. Culwick et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 120–129 refs (See N70-14751 04-08)
Avail: CFSTI

A bubble chamber experiment for a split A2 meson is reported for the reaction negative pion plus proton yields proton plus negative x, where x is a negatively charged track and one or more neutrals; the mass of x is deduced from the angle and energy of the recoil proton. A new result from a negativ Kaon (3.9 GeV/d)d exposure in an 80-inch chamber is described. The behavior and performance of analysis using road-guidance FSD are discussed. R.B.

N70-14768# Michigan Univ., Ann Arbor.
THE USE OF THE ASI 6020 ON-LINE EXPERIMENTS AT ARGONNE
C. Akerlof and J. Lales (Argonne Natl. Lab., Ill) *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 233–243 Sponsored by AEC (See N70-14751 04-08)
Avail: CFSTI

The programming of an on-line experiment for the measurement of the reaction positive pi meson + proton yields positive k meson + positive sigma hyperon using a system of wire spark chambers linked to an ASI 6020 computer by a SAC data buffer, is discussed. NSA

N70-14770# Columbia Univ., New York.
A STUDY OF SIGMA HYPERON LEPTONIC DECAY USING HPD IN A PATTERN RECOGNITION MODE
R. Newman, D. Burd, P. Franzani, L. Garder, G. Rabinowitz et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 256–265 ref (See N70-14751 04-08)
Avail: CFSTI

An automatic scan and measurement system is now in operation at Columbia University for the analysis of a sigma hyperon leptonic decay experiment. The nature of this system which is based on an HPD with real time track following, has been described previously by Burd and Teitelbaum in Current Status of Automatic Scanning at Columbia University at the International Conference on Programming for Flying Spot Devices, Munich, January (1967). The system is briefly described here and the results of its application to a particular experiment are discussed. Author (NSA)

N70-14771# Columbia Univ., New York.
A BUBBLE CHAMBER EXPERIMENT TO MEASURE THE NEUTRAL KAON BRANCHING RATIO
C. Baltay, M. Brod, D. Burd, W. Cooper, L. Gardner et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process for Bubble and Spark Chambers Jan. 1969 p 266–274 refs Sponsored by AEC (See N70-14751 04-08)
Avail: CFSTI

A bubble chamber experiment the K01 branching ratio is in progress using the Columbia University Hough–Powell Device operating in the pattern recognition mode. No prescanning or predigitizing was done on the film before the HPD scan. The experiment is now in production on the HPD: approximately 100,000 frames have been processed to date. A careful evaluation of the first 10,000 frames indicates that the system is performing in a very satisfactory manner. Author (NSA)

N70-14778# European Organization for Nuclear Research, Geneva (Switzerland).
USE OF CERN HPD 2 IONIZATION MEASUREMENTS
H. Atherton, W. Blair, J. Clayton, L. Gelnikier, V. Domingo et al *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 344–352 refs (See N70-14751 04-08)
Avail: CFSTI

In an experiment at CERN, 90,000 pp interactions at 2.8 GeV/c in the 2 metre bubble chamber are being measured with HPD 2. The first part of the experiment involves the study of 20,000 pp 6-prong interactions; these events are now being processed and the HPD bubble density information is used in order to resolve the ambiguities left after the kinematical analysis. The main problem is to distinguish between those reactions having kinematically acceptable fits to two or more hypotheses involving sets of charged particles. The techniques adopted to do an ionization fit for each kinematic hypothesis and to choose the one which best fits the data are described. Author (NSA)

N70-14781# California Univ., Berkeley. Lawrence Radiation Lab.
BUBBLE DENSITY MEASUREMENTS WITH HAZE
Giovanni Borreani, Dennis Hall, Loren Shatz, and Phillip Hanson *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 371–381 refs (See N70-14751 04-08)
Avail: CFSTI

Bubble density measurements in HAZE resolves the mass identification of events which are kinematically ambiguous, and establishes the correct mass of the charged particles in events for which two or more neutral particles are produced. The HAZE program for each track in each view measured is discussed. R.B.

N70-14782# Massachusetts Inst. of Tech., Cambridge. Lab for Nuclear Science.
PEPR'S IONIZATION MEASUREMENT
Terence L. Watts *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 382–389 (See N70-14751 04-08)
Avail: CFSTI

PEPR measures the ionization of a bubble chamber track by sweeping across it with a spot about equal in size to a bubble. A minimum ionizing track is adjusted to have 40% lacunarity (fraction of empty sweeps) and other tracks in an event are swept under the same conditions and compared in lacunarity. The ratio of logarithms of lacunarities is taken as a measure of ratio of beta squared of the tracks; a graph of this ionization measure vs momentum for pions and protons in 4C events in positive pion p collisions at 3.9 GeV/c shows a separation up to 1 GeV/c. An ionization sum of squares was constructed, minimized, and tested for each hypothesis for an event; in 99 events, this test on the ionization sum of squares was compared to the decision on ionization made by a physicist at the scan table. In no events did the test assign an event uniquely to the wrong hypothesis. In 4000 events, 10% could not be assigned uniquely to a hypothesis by PEPR ionization, but could be assigned by a physicist at the scan table. Author (NSA)

N70-14783# Argonne National Lab., Ill.
IONIZATION MEASUREMENTS ON POLLY
J. Loken *In its* Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 390–394 (See N70-14751 04-08)
Avail: CFSTI

A preliminary report on ionization measurements of particle tracks in bubble chambers with POLLY is presented. A brief description of the POLLY system is included. Results of ionization measurements for the interaction negative pion + negative pion yields positive kaon + negative kaon + positive pion + negative pion at 1.5 GeV are included. NSA

N70-14784# California Univ., Berkeley. Dept. of Physics.
IONIZATION INFORMATION FROM THE SPIRAL READER
G. Lynch *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 395 (See N70-14751 04-08)
Avail: CFSTI

The ionization data obtained from the Spiral Reader is described and the way the data differs from all other systems is discussed. NSA

N70-14785# California Univ., Berkeley. Dept. of Physics.
COMPARISON OF BUBBLE CHAMBER IONIZATION MEASUREMENTS
G. Lynch *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 396–397 (See N70-14751 04-08)
Avail: CFSTI

A comparison is made of seven methods of bubble chamber ionization measurement including HPD, TMP, FSD at BNL, FSD at LRL, PEPR, POLLY, and Spiral Reader. Three figures of merit were used for the comparison. The first was the constant k in the relation delta I equals k/square root of L where L is the length of the track in centimeters and delta I is a standard deviation in the ionization (I) for a minimum ionizing track. The second quantity is delta I for a track that is 40 cm long. The third quantity (I90) is the 90 per cent confidence level for distinguishing from minimum ionization. NSA

N70-14787# Pennsylvania Univ., Philadelphia. Dept. of Physics.
MINIMUM GUIDANCE PROGRAM AT THE UNIVERSITY OF PENNSYLVANIA
E. Bogart, J. Adler, C. Drum, T. Mc Grath, R. O'Donnell et al. *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 401–411 refs (See N70-14751 04-08)
(Contract AT(30-1)-2171)
Avail: CFSTI

The minimum guidence system at the University of Pennsylvania for processing bubble chamber film digitized on a HPD is described. The system is shown to operate in three phases: trackfollowing, track-editing, and pattern recognition. New programs being developed for HPD analysis are also briefly discussed. NSA

N70-14789# European Organization for Nuclear Research, Geneva (Switzerland).
THE STATUS OF CERN-RHEL MINIMUM GUIDANCE
J. Altaber, P. M. Ferran, S. N. Ganguli, J. M. Gerard, A. E. Heat et al. *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 421–430 refs (See N70-14751 04-08)
Avail: CFSTI

A short account of the present status of the CERN HPD Minimum Guidance chain of programs in existence at the present time is presented. Minimum Guidance means the automatic measurement of bubble chamber events given a reasonably accurate premeasurement of event vertices and possibly some help with short or difficult tracks. A clear distinction is made between what has been done, what is being done and what is planned. In general, concentration is made on what has been done. Author (NSA)

N70-14790# European Organization for Nuclear Research, Geneva (Switzerland).
THE CERN TRACK-MATCH PROGRAM FOR VERTEX GUIDANCE BUBBLE CHAMBER MEASUREMENT SYSTEMS
J. M. Gerard, W. Krischer, and D. O. Williams *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 431–433 refs (See N70-14751 04-08)
Avail: CFSTI

A status report of the CERN track match program for vertex guidance bubble chamber measurement systems is presented. Topics include identification of tracks, choice of tracks, and performance. NSA

N70-14791# Princeton Univ., N.J. Palmer Physical Lab.
TANGENT GLOBAL METHOD OF PATTERN RECOGNITION AND MEASUREMENT PARTS 1, 2, AND 3
M. E. Sekely *In* Argonne Natl. Lab. Proc. of the Intern. Conf. on Advanced Data Process. for Bubble and Spark Chambers Jan. 1969 p 444–467 refs (See N70-14751 04-08)
(Contract AT(30-1)-2137)
Avail: CFSTI

The procedure for pattern recognition of bubble chamber tracks with line elements is: recognition of points, recognition of line elements of tracks, and bubble counting. Errors in the point global method are given. The calculation of bubble chamber event parameters include accuracies of track curvatures computed by the Sagitta and by Two Tangents method, extrapolating angles and curvatures to the vertex, corrections for optical distortions in the picture taking system and CRT distortions in the original PEPR, angles and curvatures in space, and momentum calculations. Bubble chamber track parameters include spatial reconstruction of angles and curvatures by differential geometry, transformation of track angles and track element differentials, equations of the helical track, track curvatures in space, errors of the track parameters, and errors in momentum. S.J.S.

N70-14811# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Nuetronenphysik.
DEGREE OF NEUTRON SCATTERING ERROR ON BISMUTH SUBSTITUTION IN LEAD [FEHLORDNUNGSSTREUUNG VON NEUTRONEN AN SUBSTITUTIONELLEM WISMUT IN BLEI]
Hans Horst Schumacher Aug. 1969 78 p refs in GERMAN (JUEL-609-FN; D-82) Avail: CFSTI

An electron configuration model was formed that made

it possible to determine quantitatively the distribution of point defect scattering with an accuracy of 3 to 10 percent in the (110) and (001) planes of a single lead crystal containing 2 and 4 percent atomic bismuth. The scattering of subthermal neutrons was measured with six elastic detectors and compared to the effects of impulse transfer on neutrons. Measurements confirmed predicted scattering anisotropy for small impulse transfers. The path of the double force tensor was determined with an error of 30 percent and agreed generally with values deducted from macroscopic lattice parameter changes. It was found that bismuth atoms were distributed statically in the host lattice and did not form a superstructure at concentrations of 2 and 4 percent. Increased scattering at increased impulse transfers was explained by covalent bonds with three neighbors in a (111) plane positioned at an angle of 120 degrees with each other. Transl. by G.G.

N70-14812# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkorper- und Neutronenphysik.
DEFECT RECOVERY IN ELECTRON IRRADIATED METALS BY DIFFUSION OF INTER-LATTICE ATOMS [DEFEKTERHOLUNG IN ELEKTRONENBESTRAHLTEN METALLEN DURCH DIFFUSION VON ZWISCHENGITTERATOMEN]
Kurt Schroeder Jul. 1969 96 p refs In GERMAN
(JUEL-604-FN) Avail: CFSTI

Calculated is the recovery of Frenkel pairs by isotropic diffusion of interstitials for small defect densities and by considering interstitial cluster formation during low temperature irradiation with high energy electrons. It is shown that the distance between interstitials from the vacancy varies among pairs because of the impulse distribution that is transferred during electron bombardment to the lattice atom. Each interstitial reacts only with its correlated vacancy during beginning diffusion so that only a fraction of the defect engages in other reactions along wider paths. In the latter case, defects react with each other and are not correlated by radiation. A spherical model is used to express the exchange potential of interstitials and to obtain the final hole density, the time effects on density, and the cluster distributions. Comparison of theoretical results with experiments on recovery of electrical resistivity in irradiated copper, aluminum and platinum showed good agreement. Transl. by G.G.

N70-14814# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Neutronenphysik.
SPIN FLUCTUATIONS AND CRITICAL MAGNETIC SCATTERING OF NEUTRONS ON NICKEL [SPINFLUKTUATIONEN UND KRITISCHE MAGNETISCHE STREUUNG VON NEUTRONEN AN NICKEL]
Nobert Stump Jul. 1969 72 p refs In GERMAN
(JUEL-602-FN) Avail: CFSTI

Small angle elastic neutron scattering was used to determine the correlative range for spin fluctuation and magnetic effects in the vicinity of the Curie point of nickel. Temperature effects on spin elasticity were investigated by determining cut-off angles for spin waves in polycrystals and a dependency of impulse transfer on maximal temperatures was established. Transl. by G.G.

N70-14818# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
DIFFICULTY AND POSSIBILITY OF KINETIC THEORY OF QUANTUM-MECHANICAL SYSTEMS-SUPPLEMENT LINEARIZATION OF COVARIANT EQUATIONS FOR A NON-EUCLIDEAN FIELD-DERIVATION AND INTERPRETATION OF THE DIRAC EQUATION AND THE MAXWELL-LORENTZ EQUATION
Toyoki Koga Jul. 1969 40 p refs
(Contract Nonr-839; ARPA Order-52921)
(AD-695799; PIBAL-69-17-Suppl) Avail: CFSTI CSCL 20/10

The paper linearizes a set of non-linear equations which governs a non-Euclidean tensor field and is covariant in the Riemannean sense, by truncating non-linear effects in terms of mass and charge. The result is equivalent to the Dirac equation. The electronic mass and charge represent derivatives of the metric tensor in a certain manner. It seems possible to attribute the physical peculiarity of wave functions to the effect of this linearization. The Maxwell-Lorentz equations are derived by coarse-graining the same non-linear equations for a group of electrons. Author (TAB)

N70-14823# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Technische Physik.
CONSIDERATION OF INDIRECT EXCITATION OF CHARACTERISTIC X-RAY RADIATION FOR ABSORPTION CORRECTIONS IN QUANTITATIVE ANALYSES BY ELECTRON BEAM MICROSONDES [ABSORPTIONSKORREKTUREN UNTER BERUECKSICHTIGUNG DER INDIREKTEN ANREGUNG VON CHARAKTERISTISCHER ROENTGENSTRAHLUNG FUER QUANTITATIVE ANALYSEN MIT ELEKTRONENSTRAHLMIKROSONDEN]
E. Preuss Jul. 1969 53 p refs In GERMAN
(JUEL-601-TP) Avail: CFSTI

Described is a method for calculating the absorption correction in electron probe microanalysis on chemical composition of sample surface points that registers the impulse counts of the characteristic X-ray emission. Developed is a formula that represents a first approximation for calculating the concentration of chemical elements in a combination matrix. Complete intensity of the X-ray emission is obtained by summation of the first 25 to 30 layers on the probe's surface of about 0.05 to 0.1 micron density. More layers and greater depth considerations contribute only 0.3 percent to the overall intensity and can be neglected. The differential X-ray potential produced by the chemical element in a layer is determined by multiple electron scattering; the approximate diffraction correction is found by using Bothe's equation. Transl. by G.G.

N70-14838# General Electric Co., Schenectady, N.Y.
COUPLED-CHANNEL CALCULATION OF C-12 NEUTRON SCATTERING
J. T. Reynolds May 1969 18 p refs
(Contract W-31-109-eng-52)
(KAPL-P-3834) Avail: CFSTI

Coupled-channel calculations were performed for C-12 neutron cross sections at 0 to 5 MeV. The calculations resulted in very good fits to the C-12 data on total cross sections, differential elastic cross sections, and polarization. NSA

N70-14852# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Strahlenschutz.
CENTRAL DEPARTMENT FOR RADIATION PROTECTION Operations Report, 1969 [ARBEITSBERICHT 1968 DER ZENTRALABTEILUNG STRAHLENSCHUTZ]
M. Keller, and R. Tzschaschel, eds. Aug. 1969 281 p refs In GERMAN
(JUEL-603-ST) Avail: CFSTI

Radiation protection work during 1968 covered radioactivity measurements in air, water, solids, agricultural products etc. Meteorological radiation monitors were used to determine safe radioactivity levels in the atmosphere and to provide pollution criteria. A radiation dosage supervision facility analyzed external as well as internal loads of radioactivity with emphasis on safety standards for various industries, nuclear reactors facilities, chemical laboratories, and instrumentation equipment. Transl. by G.G.

N70-14936# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
PROCEEDINGS OF THE SYMPOSIUM ON THE USE OF NIMROD FOR NUCLEAR STRUCTURE PHYSICS
C. J. Batty, ed. Jun. 1968 162 p refs Symp. held in Chilton, Engl., 21 - 23 Mar. 1968
(RHEL/R166; CONF-680314) Avail: CFSTI; HMSO: 15s

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7. SCATTERING OF PIONS BY COMPLEX NUCLEI J. P. Stroot (European Organiz. for Nuclear Res., Geneva) p 81 90 refs (See N70-14942 05#35) 04-24)

8. THE STUDY OF NUCLEAR REACTIONS USING PIONS N. W. Tanner (Oxford Univ.) p 91 p 91 100 refs (See N70-14943 04-24)

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11. NEGATIVE KAON ABSORPTION D. H. Wilkinson (Oxford Univ., England) p 129 140 refs (See N70-14946 04-24)

N70-14937# Surrey Univ., London (England). Dept. of Physics.
NUCLEAR PHYSICS AT HIGH ENERGIES
L. R. B. Elton *In* Gt. Brit. Natl. Inst. for Res. in Nucl. Sci. Proc. of the Symp. on the Use of Nimrod for Nucl. Struct. Phys. Jun. 1968 p 7–17 refs (See N70-14936 04-24)
Avail: CFSTI; HMSO: 15s

The current status in theoretical and experimental studies of nuclear structure and nuclear forces is described. Theories concerning the neutron and proton radii of nuclei are discussed in detail. The use of high-energy experiments for studying these theories is suggested. NSA

N70-14938# Brookhaven National Lab., Upton, N.Y.
EXPERIMENTS USING HIGH-ENERGY PROTONS
H. Palevsky *In* Gt. Brit. Natl. Inst. for Res. in Nucl. Sci. Proc. of the Symp. on the Use of Nimrod for Nucl. Struct. Phys. Jun. 1968 p 19–32 refs (See N70-14936 04-24)
Avail: CFSTI; HMSO: 15s

Experiments in nuclear structure performed with the Brookhaven Cosmotron are reviewed. Some recently reported data on (proton, 2 proton) reactions and quasi-free scattering are given. NSA

N70-14939# Surrey Univ., London (England). Dept. of Physics.
INVESTIGATION OF THE NUCLEAR SURFACE
L. R. B. Elton and Daphne F. Jackson *In* Gt. Brit. Natl. Inst. for Res. in Nucl. Sci. Proc. of the Symp. on the Use of Nimrod for Nucl. Struct. Phys. Jun. 1968 p 33–39 refs (See N70-14936 04-24)
Avail: CFSTI; HMSO: 15s

Experimental methods which might be suitable for the study of the nuclear surface region are discussed. It is concluded that interactions of high-energy protons or pions with nuclei would yield the most information. NSA

N70-14940# Harvard Univ., Cambridge, Mass. Dept. of Physics.
THEORETICAL ASPECTS OF EXPERIMENTS USING HIGH ENERGY PROTONS
R. J. Glauber *In* Gt. Brit. Natl. Inst. for Res. in Nucl. Sci. Proc. of the Symp. on the Use of Nimrod for Nucl. Struct. Phys. Jun. 1968 p 41–65 (See N70-14936 04-24)
Avail: CFSTI; HMSO: 15s

The theory of nuclear reactions involving high-energy proton beams is discussed. Diffraction theory is discussed in detail, and the simplicity of high-energy reactions in respect to low-energy reactions is pointed out. NSA

N70-14941# European Organization for Nuclear Research, Geneva (Switzerland).
MULTIPARTICLE REACTIONS
C. Zupancic *In* Gt. Brit. Natl. Inst. for Res. in Nucl. Sci. Proc. of the Symp. on the Use of Nimrod for Nucl. Struct. Phys. Jun. 1968 p 67–79 refs (See N70-14936 04-24)
Avail: CFSTI; HMSO: 15s

Some recent developments in the study of multiparticle reactions are discussed. Some measurements on the (pion(+), 2 proton) reaction at high energies are described. Some suggestions for the use of hihg-energy beams in multiparticle reaction studies are presented. NSA

N70-14942# European Organization for Nuclear Research, Geneva (Switzerland).
SCATTERING OF PIONS BY COMPLEX NUCLEI
J. P. Stroot *In* Gt. Brit. Natl. Inst. for Res. in Nucl. Sci. Proc. of the Symp. on the Use of Nimrod for Nucl. Struct. Phys. Jun. 1968 p 81–90 refs (See N70-14936 04-24)
Avail: CFSTI; HMSO: 15s

The use of pion-meson scattering in nuclear structure studies is discussed on the basis of single scattering, single and double charge-exchange scattering, and higher-energy scattering experiments. Data on pion-mesic x rays and pion scattering by C-12 and He-4 are reported. NSA

N70-14943# Oxford Univ. (England). Dept. of Nuclear Physics.
THE STUDY OF NUCLEAR REACTIONS USING PIONS
N. W. Tanner *In* Gt. Brit. Natl. Inst. for Res. in Nucl. Sci. Proc. of the Symp. on the Use of Nimrod for Nucl. Struct. Phys. Jun. 1968 p 91–100 refs (See N70-14936 04-24)
Avail: CFSTI; HMSO: 15s

The current status of studies of nuclear reaction involving pions is discussed. Some comments are made on what may be learned by going to much higher pion energies than are currently being used. NSA

N70-14944# European Organization for Nuclear Research, Geneva (Switzerland).
THEORETICAL ASPECTS OF PION REACTIONS
T. E. O. Ericson *In* Gt. Brit. Natl. Inst. for Res. in Nucl. Sci. Proc. of the Symp. on the Use of Nimrod for Nucl. Struct. Phys. Jun. 1968 p 103–119 (See N70-14936 04-24)
Avail: CFSTI; HMSO: 15s

The theory of pion reactions with nuclei is discussed, and the interrelation between nuclear structure and elementary particle physics is noted. NSA

N70-14945# Harvard Univ., Cambridge, Mass. Dept. of Physics.
SOME REMARKS ON PION DEUTERON SCATTERING
R. J. Glauber *In* Gt. Brit. Natl. Inst. for Res. in Nucl. Sci. Proc. of the Symp. on the Use of Nimrod for Nucl. Struct. Phys. Jun. 1968 p 121–128 ref (See N70-14936 04-24)
Avail: CFSTI; HMSO: 15s

The shadow effect in diffraction theory calculations for the pion-d scattering cross section is examined. Suggestions are made for the treatment of the cross section defect. NSA

N70-14946# Oxford Univ. (England). Dept. of Physics.
NEGATIVE KAON ABSORPTION
D. H. Wilkinson *In* Gt. Brit. Natl. Inst. for Res. in Nucl. Sci. Proc. of the Symp. on the Use of Nimrod for Nucl. Struct. Phys. Jun. 1968 p 129–140 refs (See N70-14936 04-24)
Avail: CFSTI; HMSO: 15s

Properties of the absorption of negative K-mesons by nuclei are summarized. Experimental data and theoretical arguments on X-ray emission are discussed. In addition kaon capture by protons and neutrons, nucleon correlations, nuclear deformation, and isotope effects are discussed. NSA

N70-15030# Naval Research Lab., Washington, D.C.
REPORT OF LINAC OPERATION 1 JANUARY — 30 JUNE 1969
T. F. Godlove Jul. 1969 29 p
(AD-694956; NRL-MR-2031; IR-8) Avail: CFSTI CSCL 20/7

The operation and use of the NRL 60 MeV Electron Linear Accelerator is described for the period 1 January - 30 June 1969. Progress on the Linac Branch research program is discussed, including results from 180 degree electron scattering on 3He and 4He, installation of an improved bremsstrahlung converter for photonuclear experiments, and studies of resonance neutron capture. Various linac engineering improvements are discussed. Author (TAB)

N70-15042# Naval Research Lab., Washington, D.C. Quantum Optics Branch.
OPTICAL THIRD-HARMONIC MEASUREMENTS OF SUBPICOSECOND LIGHT PULSES
R. C. Eckardt and C. H. Lee *In its* Rept. of NRL Progr. Nov. 1969 p 5–8 refs (See N70-15040 04-34)
Avail: CFSTI

This new technique makes use of the unique polarization properties of optical third-harmonic generation for the measurement of picosecond light pulses. At half-maximum intensity, a pulse width of less than 0.73-picosecond is observed for a mode-locked neodymium glass laser. Author

N70-15084 Northwestern Univ., Evanston, Ill.
NON-LINEAR AND COLLISIONAL EFFECTS ON LANDAU DAMPING
Brian Webster Doyle (Ph.D. Thesis) 1968 81 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-6914

In the collisionless case, nonlinear effects considerably reduce Landau damping after a time of the order of the period of oscillations of trapped electrons. A perturbation analysis of the nonlinear Vlasov equation, modified by the addition of a simplified Fokker – Plank collision term, is carried out following Montgomery's expansion technique. The modified Landau poles for Maxwellian plasmas are determined. The first and second order number densities and the second order spatially homogeneous distribution function are evaluated in terms of the collision parameter beta, wavelength lambda and initial amplitude epsilon. The competing effects of nonlinearities and collisions on the formation of a plateau in the spatially homogeneous distribution functions are studied. Values of beta which prevent the formation of the plateau and maintain Landau damping close to the value prescribed by the linear theory are determined. Dissert. Abstr.

N70-15085 Washington Univ., Seattle.
TIME-DEPENDENT NEUTRON THERMALIZATION IN HETEROGENEOUS MEDIA
Richard Walter Beckmann (Ph.D. Thesis) 1968 145 p
Avail: Univ. Microfilms: HC $6.80; Microfilm $3.00 Order No. 69-7033

A procedure is given for an approximate solution to the space-time, multispeed diffusion theory in a finite medium with a finite number of absorption discontinuities. The method used, based on the source-sink formalism of Meetz, is an expansion in a double series of space-energy coupled eigenfunctions. The objective is the calculation of the decay constant and spectrum of the thermalized neutron flux following an initial pulse of fast neutrons. The analysis of time-dependent buckling experiments in heterogeneous moderators perturbed by strong absorbers is discussed. The results of fundamental-mode, space-energy coupled, decay constant calculations for slab geometries using realistic scattering kernels are qualitatively compared with experiment. Proper treatment of the energy dependence of the transport mean free path is crucial to the understanding of time-dependent measurements designed to infer buckling changes induced by absorbing materials. Dissert. Abstr.

N70-15097 Florida Univ., Gainesville.
DETERMINATION OF HETEROGENEOUS PARAMETERS BY THE NEUTRON WAVE TECHNIQUE
Emile Anthony Bernard (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.00; Microfilm $3.00 Order No. 69-5379

The neutron wave technique was used to study a heterogeneous system consisting of a natural uranium rod surrounded by a moderator of heavy water. By considering only a simple unit cell configuration, the theoretical derivations are simplified and one can perform a relatively simple and inexpensive experiment. The experimental technique applied permits the measurement of several heterogeneous parameters and can be used to study other fuel-moderator systems. The Feinberg – Galanin Constant, gamma, was measured. This measurement was accomplished by first obtaining the experimental dispersion law for the unit cell. Next, the theoretical dispersion law is computed for various values of gamma. The theoretical model used is the Age-Diffusion Model. By using a series of transformations and an expansion in transverse eigen-functions, the two coupled equations are solved for the thermal flux. Inversion of the solution yields the theoretical dispersion law. Dissert. Abstr.

N70-15113# Rochester Univ., N.Y. Dept. of Chemistry.
NUCLEAR REACTION MECHANISMS Progress Report, 1 May 1968 – 1 May 1969
Marshall Blann 1 May 1969 19 p refs
(Contract AT(30-1)-3591)
(UR-3591-10) Avail: CFSTI

Progress is reported for research on proton inelastic scattering by and proton spectra for palladium 104; beta and electron-capture decay of ground-state and isomeric silver 104, rhodium 104, and cadmium 104, and gamma spectra for these isotopes; palladium 104 energy levels from rhodium 104 and silver 104 decays; and silver 104 energy levels from cadmium 104 decay. NSA

N70-15126# Army Foreign Science and Technology Center, Washington, D.C.
ESTIMATION OF THE COEFFICIENT OF MERIDIONAL MACROTURBULENT DIFFUSION IN THE EQUATORIAL STRATOSPHERE ON THE BASIS OF RADIOACTIVE PRODUCT CONTENT OF NUCLEAR EXPLOSIONS
I. L. Karol 2 Oct. 1969 14 p refs Transl. into ENGLISH from Tr. Inst. Prikl. Geofiz. (Leningrad), no. 8, 1967 p 49–53
(AD-695733; FSTC-HT-23-528-69) Avail: CFSTI CSCL 4/1

According to published results of aircraft and balloon measurements of the concentration of strontium-90 and manganese 54 in the equatorial stratosphere (17 to 37 kilometers), the quantity of isotopes borne through this zone 1963 and 1964 is determined, also the main value of the interlatitude gradient of their average concentration for the same period. These values make it

possible to evaluate the average magnitude of the coefficient of meridian large-scale turbulent exchange in the equatorial stratosphere in 1963 and 1964. Author (TAB)

N70-15144 Texas A&M Univ., College Station.
AXIAL PROPAGATION NEUTRON WAVES IN HETEROGENEOUS MEDIA
Md. Abdul Quddus (Ph.D. Thesis) 1968 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-5147

A theoretical study of the axial propagation of plane-thermal-neutron waves in a semi infinite heterogeneous subcritical assembly containing cylindrical fuel rods in a square pattern is performed in the framework of the p-1 approximation to the Boltzmann equation. An oscillating plane source of thermal neutrons placed at one face of the assembly is assumed to inject a plane wave of thermal neutrons which propagate along a direction parallel to the fuel rods. The thermalization effect is considered by assuming a time delay prior to appearance of the fission neutrons in the thermal group. The analysis predicts that the phase interference between the modes of propagation in the axial direction may give rise to resonances in the frequency response of the asymptotic moderator flux. A standing-wave-pattern is also predicted in the amplitude distribution of the oscillating part of the moderator flux in the axial direction. Dissert. Abstr.

N70-15164*# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE DEVICE INVESTIGATIONS Semiannual Progress Report, 1 Apr. - 1 Oct. 1969
W. R. Curtice, W. D. Getty, G. I. Haddad, and R. J. Lomax Oct. 1969 22 p refs
(Grant NGL-23-005-183)
(NASA-CR-107557; SAPR-8) Avail: CFSTI CSCL 20H

Progress in the areas of beam plasma interactions, paramagnetic and bulk semiconductor materials for millimeter and submillimeter wave detection, and avalanche microwave diodes analysis is summarized. Experimental data are presented for work completed in cyclotron harmonics and millimeter wave Gunn effect devices. Results are given for velocity distribution measurements and computations in cyclotron harmonic instabilities. J.M.C.

N70-15173# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultaet.
QUASI-ELASTIC ELECTRON DEUTERON SCATTERING AT QUADRUPLE IMPULSE TRANSFERS BETWEEN 18 f TO THE MINUS 2 POWER AND 100 f TO THE MINUS 2 POWER [QUASIELASTISCHE ELEKTRON DEUTERON STREUUNG BEI VIERERIMPULSUEBERTRAEGEN ZWISCHEN 18 F(-2) UND 100 F(-2)]
Wolfgang Albrecht (Ph.D. Thesis) 12 Jul. 1968 57 p refs In GERMAN
Avail: CFSTI

The correlation between quasi-elastic electron-deuteron scattering cross sections and elastic electron-proton scattering cross sections was determined for quadruple impulse transfer at electron scattering angels of 48 and 75 degrees. The "scaling law" was used to obtain from elastic electron-nucleon scattering cross section values the quadrature of the electrical neutron form factor; with one exception, positive form factors with a maximum of about 0.01 were found. Transl. by G.G.

N70-15213*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
EQUATION FOR THE EFFECTIVE POTENTIAL OF AN ATOM WITH OSCILLATORY CORRECTIONS [URAVNENIYE DLYA EFFEKTIVNOGO POTENTSIALA ATOMA S OSTSILLYATSIONNOY POPRAVKOY]
O. V. Troshin Washington NASA Dec. 1969 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 5, 1968 p 36-41
(Contract NASw-1692)
(NASA-TT-F-12736) Avail: CFSTI CSCL 20H

An equation for the effective potential of an atom on the Thomas-Fermi model is examined. An equation is derived for an oscillatory correction to the potential provided by the nonanalytic function relating electron density and the Planck constant. An equation for exchange and quantum corrections to potential in the framework of the examined approximations is compared with the Kompaneyets and Pavlovskiy equation. The exchange, quantumi, and oscillatory corrections to the radial electron density of an atom are compared. Author

N70-15219*+ Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETERMINATION OF DIFFERENTIAL ELASTIC AND VIBRATIONAL EXCITATION CROSS SECTIONS FOR e-H SUB 2 SCATTERING
S. Trajmar, J. K. Rice (AEC), D. G. Truhlar (AEC), R. T. Brinkmann, and A. Kuppermann (AEC) 1968 9 p refs Presented at 6th Intern. Conf. on the Phys. of Electron. and Atomic Collisions, Cambridge, Mass.
(Contract NAS7-100; AT(04-3)-767)
(NASA-CR-107581; CALT-767-P-4-43; CONF-690702-4) Avail: CFSTI CSCL 20H

The elastic scattering of electrons by H2 was studied together with the pure vibrational excitation. Angular distributions of the elastically and inelastically scattered electrons causing the fundamental and first and second overtone excitations were measured in the 8 to 80 deg range. Certain aspects of the experimental procedures and the angular behavior of some of the inelastic-to-elastic scattering intensity ratios (R) at 7- and 60-eV impact energies are presented. Author (NSA)

N70-15314# Ghent Univ. (Belgium). Inst. for Nuclear Sciences.
NEUTRON, PHOTON AND CHARGED PARTICLE REACTIONS FOR ACTIVATION ANALYSIS
J. Hoste, D. De Soete, R. Gijbels, and J. Hoeste *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 699-750 refs (See N70-15313 04-06)
Avail: SOD $8.50

Methods of calculation and results are presented for neutron induced, gamma induced, and charged particle reactions pertaining to activation analyses. Neutron energy consideration energies, thresholds, cross sections, and reaction rates are determined, emphasizing reactor neutrons. Fast neutron activation analysis and reactor, thermal, and resonance fluxes are also computed. In gamma particle and gamma ganima reactions, the incident photon energy and the structure of the energy levels of the reacting nucleus are considered of essential importance. The reaction thresholds and rates, photon nucleus cross sections, and the bremsstrahlung spectra of high energy photons produced by energetic electron bombardment are described. The complexity of the charged particle reactions due to the Coulomb barrier considerations is taken into account, and the excitation functions, flux, and range are calculated. Attention is given to the calibration of the induced activity in charged particle analysis. N.E.N.

N70-15316# Lyon Univ. (France).
STUDY OF A BEAM OF CHARGED PARTICLES; THEIR SLOWING DOWN, AND THEIR ENERGY DISTRIBUTION IN A THICK, COMPLEX TARGET FOR ACTIVATION ANALYSIS
Minh Duc Tran and Jean Tousset *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 754-767 refs (See N70-15313 04-06)
Avail: SOD $8.50

Methods are described for the measurement of beam energy

and resolution and the determination of the energy and resolution loss in complex chemical compounds. A mathematical expression is given for the stopping power, energy straggling, excitation functions, and activation curves. Graphs of the calculated data are included. N.E.N.

N70-15316*# Texas A&M Univ., College Station. Activation Analysis Research Lab.
RANGE TRANSFORMATION OF ACTIVATION CURVES AND THEIR APPLICATION TO QUANTITATIVE CHARGED PARTICLE ACTIVATION ANALYSIS
H. L. Rook, E. A. Schweikert, and R. E. Wainerdi *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 768–773 refs Sponsored in part by NASA (See N70-15313 04-06)
(Grant NSF GP-8200)
Avail: SOD $8.50 CSCL 20H

A technique is described by which one complete, well defined activation curve can be transformed into the corresponding activation curve of any matrix for trace element determinations. Stacks of Mylar, mica, and aluminum foils were irradiated, and activation curves were determined giving the relative cross section as a function of thickness. The experimentally determined curve for the reaction O-16(alpha,pn)F-18 in mica was compared with a curve obtained by the method of range transformation from a curve experimentally determined in Mylar. Agreement was considered to be excellent. A similar experiment with high purity aluminum foils was performed, and after a correction was made for interference due to aluminum, agreement was also considered to be good. N.E.N.

N70-15318# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.
INFLUENCE OF CHANNELING IN CUSTOMARY He-3 ACTIVATION ANALYSIS
Enzo Ricci *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 785–790 refs Sponsored by AEC (See N70-15313 04-06)
Avail: SOD $8.50

A study was set up with a much higher degree of optical alignment than customary charged particle activation analysis to investigate the channeling effects. A Ge single crystal ingot was cut into numerous slices perpendicularly to its 111 axis. Each slice was bombarded at a different angle and counted. Though nculear reaction products from impurities (C and O) were observed, only products from Ge were taken into account. Results show that within experimental error the induced radioactivity is independent of irradiation angle. It is concluded that channeling effects cannot generally influence the customary activation analysis methods. Author

N70-15321# Southern Univ. Nuclear Inst., Faure (South Africa).
THE DETERMINATION OF STABLE CALCIUM ISOTOPES BY CHARGED PARTICLE IRRADIATION
Max Peisach and Rene Pretorius *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 802–810 refs (See N70-15313 04-06)
Avail: SOD $8.50

Proton and deuteron activation was carried out with the 6 MeV Van de Graaff accelerator and alpha activation at the cyclotron where energies up to about 32 MeV could be attained. Irradiations lasted up to 2 hours and beam currents between 2 and 5 microamps were used. After irradiations, samples were analyzed either by gamma ray spectrometry or gross gamma ray counting with an NaI(Tl) scintillation detector. The energy of the prompt neutrons emitted during irradiation was measured by the time-of-flight technique. Determinations of Ca-43 and Ca-48 were made and the results are tabulated. Author

N70-15324# National Bureau of Standards, Washington, D.C.
SELF-SHIELDING CORRECTIONS IN PHOTON ACTIVATION ANALYSIS
G. J. Lutz *In its* Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 829–834 refs (See N70-15313 04-06)
Avail: SOD $8.50

The effect of the difference in absorption of the bombarding particles between sample and standard was evaluated for high energy photon activation analysis. Powders of MgO, PbO, and a mixture of the two were encapsulated into cylindrical vials 0.95 cm in diameter and 2.1 cm long. The resulting Na-24 and Pb-203 decays were counted immediately after irradiation and again after a week's delay. The count rates were calculated and corrected for decay and flux monitor. The relationship between the logarithm of specific activity and the sum of the products of the gamma ray attenuation coefficient and the density of each element was determined and an example graph is included. N.E.N.

N70-15328# Veterans Administration Hospital, Boston, Mass.
Be-7 AS A DOSIMETER DURING PHOTON ACTIVATION OF IODINE
J. A. Cardarelli, E. S. Deil, and B. A. Burrows *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 847–852 refs Prepared in cooperation with Yale Univ. (See N70-15313 04-06)
Avail: SOD $8.50

Experiments for biomedical purposes are briefly described which use irradiated iodine and a Be-7 detector having a photopeak of 0.48 MeV. Potassium iodide solutions were irradiated, and the radioactivity–iodide concentration relation was found to be linear. Inulin tagged with nonradioactive iodine was also irradiated, and a linear relation was again noted. It is concluded that the Be-7 photopeak of 0.48 MeV can be used as an accurate dosimeter for measuring the uniformity of the radiation flux to the samples. N.E.N.

N70-15329# Gulf General Atomic, San Diego, Calif.
SOME RECENTLY DETERMINED PHOTONUCLEAR REACTION YIELDS AND CROSS SECTIONS FOR FORMATION OF SEVERAL ISOMERS
H. R. Lukens *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 853–856 refs (See N70-15313 04-06)
Avail: SOD $8.50

Photoactivation yields and photoexcitation cross sections are presented. The yield values are for radionuclides produced by the irradiation of Se, Y, Ce, Pr, Nd, Er, and Au for one hour with bremsstrahlung from a 15 MeV, 4.8 kW electron beam. The results indicate that the elements can be determined with fairly good sensitivity. The cross sections are for metastable isomers formed by photonuclear excitation. N.E.N.

N70-15330# Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands).
SPECTRUM, YIELD AND USE OF FAST NEUTRONS PRODUCED BY 20 MeV HELIUM-3 IONS, 14 MeV PROTONS AND 7.5 MeV DEUTERONS ON A THICK BERYLLIUM TARGET
E. Bruninx *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 860–867 refs (See N70-15313 04-06)
Avail: SOD $8.50

Procedures are described for the determination of fast neutron yields, neutrons produced on a beryllium target are examined by these techniques, and the advantages and disadvantages for activation analysis are described. In the method of threshold detectors, a sandwich detector of metal and carbon foils is irradiated in the fast neutron beam, and both the fast neutron spectrum and flux are

determined. In the second method, neutron fluxes are obtained with a cadmium shielded paraffin-indium detector. Graphs of neutron spectra and angular distributions are included. It is considered that the strong forward peaking of the emitted neutrons is one of the big assets of cyclotron produced neutrons, and that the variability of neutron energy presents a number of attractive aspects in activation analysis. N.E.N.

N70-15331# Cyclotron Corp., Berkeley, Calif.
THE PRODUCTION OF FAST NEUTRONS BY SMALL CYCLOTRONS
A. A. Fleischer *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 868–873 refs (See N70-15313 04-06)
Avail: SOD $8.50

The possibilities of using small compact cyclotrons for producing high fluxes of fast neutrons are described, and energy and yield calculations are given. The nuclear disintegration energy and angular distribution of neutrons in the charged particle reactions are discussed, and neutron energy data for several reactions are tabulated. N.E.N.

N70-15332# Naval Research Lab., Washington, D.C.
USE OF A 60 MeV LINAC FOR FAST AND VARIABLE ENERGY NEUTRON ACTIVATION ANALYSIS
Peter E. Wilkniss *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 874–878 refs (See N70-15313 04-06)
Avail: SOD $8.50

Experiments are described which use bremsstrahlung obtained from two types of converters. Two different electron beams were also used, one the straight through beam of about 145 microamps and the other deflected 45 deg with currents up to 80 microamps. Measurements were made of the angular distributions of neutrons and bremsstrahlung, neutron energy spectra, absolute neutron intensities, and count rates obtained from activation of different elements. The counting rates are given and indicate that the sensitivities obtained permit minor constituent analysis. It is expected that the use of higher beam current and special source will increase the sensitivity to permit trace analysis. The possibility of variable energy neutron activation analysis is considered to be demonstrated by the determination of fluorine according to F-19(n,alpha)N-16 in the presence of large amounts of oxygen. N.E.N.

N70-15335# Kaman Nuclear, Colorado Springs, Colo.
LONG TERM OPERATING EXPERIENCE WITH HIGH YIELD, SEALED TUBE NEUTRON GENERATORS
P. L. Jessen *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 895–899 refs (See N70-15313 04-06)
Avail: SOD $8.50

Data from laboratory life tests and consumer case histories are presented for the A-3043 and A-3045 accelerators. The data are considered to show that the life tests are valid indicators of expected use life, and that operating periods of a few months may be expected before changing of the accelerator tube is required. N.E.N.

N70-15336# Services Electronics Research Lab., Baldock (England).
A 10 TO 11th POWER NEUTRONS PER SECOND TUBE FOR ACTIVATION ANALYSIS
D. W. Downton and J. D. L. H. Wood *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 900–904 refs (See N70-15313 04-06)
Avail: SOD $8.50

Design details of the sealed-off tube utilizing the deuterium–tritium reaction are given and the operating parameters are listed. The average life of test tubes was 120 hours. The extension of useful life is attributed to targets 20 times thicker than conventional targets. N.E.N.

N70-15337# Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands).
A HIGH OUTPUT SEALED-OFF NEUTRON TUBE WITH HIGH RELIABILITY AND LONG LIFE
O. Reifenschweiler *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 905–910 refs (See N70-15313 04-06)
Avail: SOD $8.50

A neutron generator is described which is based on the H-3(d,n)He-4 reaction and gives an output up to 10 to the 11th power n/sec with very good reliability and a life of more than 1000 hours. The ion generation and acceleration are described, along with the self-loading target containing an equal mixture of tritium and deuterium ions, hydrogen pressure regulator, and a metal cylindrical shield with oil between the tube and shield. It is felt that the compact robust tube is suitable for activation analysis. N.E.N.

N70-15339# Toronto Univ. (Ontario). Dept. of Chemical Engineering.
FAST NEUTRON CONTINUOUS ACTIVATION ANALYSIS OF DILUTE SOLUTIONS
R. E. Jervis, H. Al-Shahristani, and S. S. Nargolwalla (NBS, Washington, D.C.) *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 918–924 (See N70-15313 04-06)
Avail: SOD $8.50

Apparatus design and experimental procedures are described for the flow activation studies made in trace fluoride, vanadium, and uranium aqueous systems. The nuclear reactions used and the optimal flow conditions are listed, and experimental data were found to confirm computer predictions. It was concluded that the twin-stream, twin-detector arrangement can be replaced by a single cell system with improved sensitivity of measurement. N.E.N.

N70-15340# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh. Nuclear Research Center.
USE OF VERY SHORT-LIVED NUCLIDES IN NONDESTRUCTIVE ACTIVATION ANALYSIS WITH A FAST SHUTTLE RABBIT
M. Wiernik and S. Amiel *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 925–928 refs (See N70-15313 04-06)
Avail: SOD $8.50

The usefulness of subsecond half life radionuclides in activation analysis was explored using a steady-state operating reactor, a shuttle rabbit, and NaI(Tl) scintillation spectrometry. The special problems are corrections due to rapidly decaying spectra, deadtime variations, and sensitivities in the presense of different interferences. The 0.8 sec Pb-207 isotope was taken as a representative starting case. Author

N70-15341*# Mobil Research and Development Corp., Dallas, Tex. Field Research Lab.
CYCLIC ACTIVATION ANALYSIS
W. W. Givens, W. R. Mills, Jr., and R. L. Caldwell *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 929–937 refs (See N70-15313 04-06)
(Contract NASw-1435)
Avail: SOD $8.50 CSCL 20H

Cyclic activation analysis utilizes very efficiently a low output, pulsed source of 14 MeV neutrons and cyclic counting of induced activities. The main differences between cyclic activation and mechanical sample transfer are that in cyclic activation (1) the

sample in most applications of the method is fixed with respect to both the irradiating source and the detector (2) cycling is electronic rather than mechanical, and (3) activities with half lives down to a few milliseconds may be utilized for analytical purposes. The mathematical analysis of cyclic activation, experimental studies, and application of this technique to specific analysis problems are discussed. Author

N70-15345# Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.

CALIFORNIUM-252: A NEW NEUTRON SOURCE FOR ACTIVATION ANALYSIS

W. C. Reinig and A. G. Evans *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 953–957 refs (See N70-15313 04-06)
(Contract AT(07-2)-1)
Avail: SOD $8.50

Californium-252 is a valuable new neutron source for activation analysis. The cost of this radionuclide and the relatively simple shielding it requires indicate its promise for analytical, forensic, hospital, and university laboratories. The high neutron yield from minute sources and their transportability makes Cf-252 practical for mineral exploration and geophysical studies in remote environments on land, undersea, or extraterrestrial. Where a continuous, dependable, high neutron flux is required such as for industrial process control, Cf-252 has unique advantages over other sources. Author

N70-15376# Gulf General Atomic, San Diego.

RAPID MANUAL RESOLUTION OF MULTI-COMPONENT GAMMA-RAY PHOTOPEAKS

H. R. Lukens *In* Natl. Bur. of Std. Mod. Trends in Activation Analysis, Vol. 2 Jun. 1969 p 1250–1255 refs (See N70-15313 04-06)
Avail: SOD $8.50

A manual method for resolving overlapping peaks is described that is analogous to a previous procedure in that the histogram nature of the data is recognized, and a normal probability of distribution is assumed. The present method, however, features a simplified calculation involving only one basic equation and use of an established table of the normal curve of error. Three experiments were conducted to test the computational method: (1) a procedure to obtain single components of composite photopeaks by either the single equation or a simultaneous equation technique; (2) a variation of the basic method which does not require use of the above-mentioned table; and (3) analysis of a peak that may appear to have only one component. Author

N70-15444# United Kingdom Atomic Energy Authority, Harwell (England).

AN ION SOURCE FOR INTENSE BEAMS OF NEGATIVE HEAVY IONS

G. Hortig et al Apr. 1969 3 p ref Transl. into ENGLISH from Z. Physik (Berlin), no. 210, 1968 p 312–313
(NP-tr-1829; LB/G/2855) Avail: CFSTI

A rotating disc target with a continuously activated surface film by vapor deposition is described for the production of negative heavy ions by inert gas ion bombardment. Currents of various negative ions obtained from targets vapor coated with cesium are listed. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-14111# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.

INDUCTION VELOMETRY IN SHOCK WAVE OF PARTIALLY IONIZED GAS

G. Mamimoto and M. Nishida Aug. 1969 20 p refs
(CP-27) Avail: CFSTI

The induced potential gradient profile across the shock is obtained with an assumption that the velocity of the charged particles is given by Mott-Smith's result. The calculated result of the induced potential gradient shows that it is not proportional to the velocity of the charged particles since eddy currents are induced owing to the existence of nonuniform velocity through the shock. The induced potential gradient is measured across the shock produced by a shock holder. This result is compared to the theoretical result. The experimental result shows that the charged particles follow the Rankine-Hugoniot relation in the velocity. Author

N70-14112# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.

CALCULATION OF ELECTRON TEMPERATURE PROFILE ACROSS A SHOCK WAVE IN A NONEQUILIBRIUM, PARTIALLY IONIZED GAS FLOW

Goro Kamimoto, Michio Nishida, and Toshiyuki Inui Dec. 1968 33 p refs
(CP-26) Avail: CFSTI

The electron temperature profile across a normal shock wave in a nonequilibrium, partially ionized gas flow was calculated for both cases of chemically frozen flow and recombining flow. For the former case, the calculation was made by extending the Grewal method, and its result was compared with the result obtained by integrating directly the electron energy equation by Runge-Kutta-Merson method. For the recombining flow case, the continuity equation and the energy equation of the electrons were directly integrated, assuming that the three body recombination and the radiative recombination were dominant. Author

N70-14139# Iowa Univ., Iowa City. Dept. of Electrical Engineering.

COMPUTER SIMULATION OF FLUID ION MOTION IN PLASMAS

Melvin Merle Winder (Ph.D. Thesis) Aug. 1969 80 p refs
(TID-25184) Avail: CFSTI

Several nonlinear plasma problems are solved by computer simulation with some experimental confirmation. All the problems involve plasma boundaries and events occurring on the time scale of the ion motion. The problems are: (1) ion sheath evolution and the accompanying ion-acoustic wave excitation, (2) interaction of an ion-acoustic wave with a steady-state ion space-charge sheath, and (3) plasma expansion into a vacuum. The computer simulation assumes a fluid model for cold ions and a thermal equilibrium model for hot background electrons. Author (NSA)

N70-14142# Academy of Sciences (USSR), Moscow. Inst. Atomnoi Energii.

MEASURING THE PLASMA ENERGY IN THE TOKAMAK-3 DEVICE

S. V. Smirnov Jul. 1969 48 p refs Transl. into ENGLISH from A Russian Report
(MATT-TRANS-87) Avail: CFSTI

The transverse component of the energy was determined by the magnitude of the diamagnetic effect of the plasma, and the longitudinal component by the magnitude of the equilibrium shift of the plasma column. The diamagnetic flux value was measured against a background of paramagnetic and quasiconstant magnetic fluxes exceeding it by 10 and 10 to the 4th power times. This situation imposed very strict requirements on the measuring scheme making detailed analysis of its elements and performance of additional calibration experiments necessary. The accuracy of the measurements was estimated, and the values of E obtained are presented as functions of the discharge parameters. Author (NSA)

N70-14341# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

EFFECTS OF AZIMUTHAL COMPONENTS OF THE ELECTRIC FIELD IN A Q-DEVICE [DIE ROLLE AZIMUTALER KOMPONENTEN DES ELEKTRISCHEN FELDES IN EINER Q-MASCHINE]

E. Guilino Mar. 1969 55 p refs In GERMAN; ENGLISH summary

(IPP-2176) Avail: CFSTI

Azimuthal components of the electric field in Q-machine plasmas may occur if the distribution of temperature over the endplate is deviating from rotational symmetry. In this case, drifts give rise to plasma loss rates which may be comparable in magnitude to Bohm Diffusion. This effect is verified experimentally in a double-ended Q-machine (ALMA III). A new heater system for the endplates using rotating cathodes yields temperature distributions which are symmetrical within less than 0.1%. Under these conditions the loss rate is reduced by a factor 10 ... 60 as compared to the operation with conventional heater systems. Author

N70-14344# Hokkaido Univ., Sapporo (Japan). Research Inst. of Applied Electricity.

A NEW METHOD FOR MEASURING O SUB 2 AND CO SUB 2 IN GAS BY USING A GLOW DISCHARGE

Masaji Mochizuki, ed., Yoshihiro Kakiuchi, Takehito Nakabayashi, and Takashi Arai 1969 70 p refs *Its* Monograph Ser. No. 17 Avail: CFSTI

A method for measuring oxygen and carbon dioxide in expired gas and the fundamental problems underlying the technique were studied. In addition, oxygen and carbon concentrations in expired gas were measured to determine the concentration of these gases in pulmonary blood flow. R.B.

N70-14382# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL STUDY OF A COAXIAL PLASMATRON WITH NATURAL GAS

A. A. Voshchenko et al 30 Apr. 1969 7 p Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Sibirskoe Otd., Ser. Tekhn. Nauk (USSR), no. 3, 1967 p 163–165

(AD-695884; FTD-HT-23-54-69) Avail: CFSTI CSCL 20/9

The results of an experimental study of a coaxial plasmatron with magnetic stabilization of the electric arc are presented. The construction of the plasmatron is shown. The directions of circulation of the arc and gas are opposed in the first series of experiments. In the second series the gas flow in the vicinity of the arc is noncirculating. Conditions for the appearance or absence of coking of the inner electrode are described. Author (TAB)

N70-14417# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TRANSITION OF COMBUSTION FROM THE SURFACE OF A METALLIC PARTICLE TO THE VAPOR PHASE

M. A. Gurevich et al 3 Apr. 1969 14 p refs Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (Leningrad), no. 280, 1967 p 91–97

(AD-695202; FTD-HT-23-1272-68) Avail: CFSTI CSCL 21/9

A study was made at the Department of Thermal Physics of the Leningrad Polytechnical Institute to analytically determine the conditions under which the combustion process which develops on the surface of a metal particle results in the ignition of the metal vapors, i.e., the transition from surface- to vapor-phase burning. It was shown that any magnesium particle heterogeneously ignited will burn in the vapor phase. It was also shown that the analytical analysis applied only to those cases where the oxide layer on the particle surface does not considerably affect the transfer of heat and the reactants. Author (TAB)

N70-14420# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EROSION OF METALS BY A PULSED PLASMA STREAM

V. A. Morozov et al 21 Apr. 1969 9 p refs Transl. into ENGLISH from Akad. Nauk Belorussk. SSR, (USSR), v. 12, no. 5, 1968 p 413–416

(AD-695923; FTD-MT-24-68-69) Avail: CFSTI CSCL 20/9

Additional results are reported on work designed to establish the erosion of metal surfaces subjected to pulse flows of plasma. The initial work reported previously was limited to observations utilizing a 900 Joule discharge. Here the effects of discharge energy variation are studied. The metallic samples in the form of plates were placed 4.5 mm from the plasmatron nozzle. In all the samples studied (Pb, Al, Cu, Fe, Ni) erosion occurs at all discharge energies. It shows that molten metal leaves the central spot and is ejected radially. Basically, two regimes of operation were found: when the discharge energy was less than 200 Joules, the mass leaving the central crater was deposited radially; when a higher energy was used, most of the molten and evaporated metal left the sample. The experiments suggest that a strong similarity exists between the erosion of metals by plasma streams and electrode erosion in electric discharges. TAB

N70-14426# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE TURBULENT MHD BOUNDARY LAYER IN A TRANSVERSE MAGNETIC FIELD

I. P. Ginzburg et al 21 Apr. 1969 22 p refs Transl. into ENGLISH from Uch. Zap. Leningr. Gos. Univ. (Leningrad), no. 338, 1968 p 59–74

(AD-695014; FTD-HT-23-175-69) Avail: CFSTI CSCL 20/9

The turbulent boundary layer of an MHD-flow over a flat plate is analyzed. The applied magnetic field is assumed to be transverse to the flow, with all induced effects neglected. The shear stress and the flow enthalpy are expressed as quadratic profiles of the boundary layer coordinate and velocity. The electric conductivity is assumed constant and the electric field component in the cross flow direction is neglected. Solutions are obtained for the skin friction coefficient, both with and without the pressure gradients using the momentum integral method. Although the equations are given for a compressible flow, solutions are obtained only for incompressible flows. Author (TAB)

N70-14497# Columbia Univ., New York. Electronics Research Labs.

TRANSIENT PROBE DIAGNOSTICS OF DENSE PLASMAS Final Report, 1 Jun. 1966 – 31 May 1967

C. Sheer, P. S. Tschang, and C. G. Stojanoff Wright-Patterson AFB, Ohio ARL Jul. 1969 187 p refs

(Contract AF 33(615)-3165)

(AD-695052; ARL-69-0105) Avail: CFSTI CSCL 20/9

This report describes the accomplishments of a two-year project on the development of transient probes for the diagnostics of moderately dense (0.1 to 10 atm) plasmas. The types of probes investigated include a Hall magnetic probe, a thermocouple probe, a fiber optics probe, and a dynamic pressure Pitot tube probe. In each case the sensing element or probe tip is driven through the hot plasma at high speeds (e.g., 1 to 7.5 m/sec) and immersion times are restricted to the millisecond range. The sensing elements are miniaturized so as to respond to plasma conditions as localized as possible, and to reduce perturbations of the plasma itself. Fast response instrumentation is utilized to provide a direct measure of the variation of plasma parameters along the line of the probe traverse. Short immersion times plus some insulation are relied upon to prevent thermal damage to the probes. Author (TAB)

N70-14532# Oak Ridge National Lab., Tenn.

THERMONUCLEAR DIVISION Annual Progress Report for Period Ending 31 December 1968

Jun. 1969 241 p refs
(Contract W-7405-eng-26)
(ORNL-4401) Avail: CFSTI

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N70-14533# Oak Ridge National Lab., Tenn.
PLASMA THEORY AND COMPUTATION
In its Thermonuclear Div. Jun. 1969 p 1–24 refs (See N70-14532 04-25)
Avail: CFSTI

The linear stability of a spatially uniform plasma is examined whose distribution functions model the velocity-space properties of target plasmas. If electron temperatures are too low, the important stabilizing influence of Landau damping is lost. If the electron temperature is too high, new classes of ion-ion interaction may occur. The optimum electron temperature is roughly that of the hot ions. Regarding the two-ion-group problem, stability is best achieved by raising the warm-ion temperature to about 10% of the hot-ion temperature. Under these conditions and for relative densities less than 0.1, the flutelike modes are linearly stable. When the temperatures are less than 0.05, rapidly growing flutelike modes may occur when density is greater than 0.01, provided the hot-ion density is large enough. The frequency and wavelength of the fastest-growing modes are related to resonance conditions between the warm-ion hybrid frequency and hot-ion cyclotron harmonics, resulting in the excitation of high-frequency, short-wavelength modes in the buildup state of a typical target plasma experiment. These instabilities may saturate at relatively low levels through rapid phase mixing, and may not be catastrophic to hot-ion accumulation.
NSA

N70-14534# Oak Ridge National Lab., Tenn.
TARGET PLASMAS
J. L. Dunlap and N. H. Lazar *In its* Thermonuclear Div. Jun. 1969 p 25–44 refs (See N70-14532 04-25)
Avail: CFSTI

The initial prospect that an energetic-ion plasma will be more stable in a hot-electron environment was based primarily on the thought that a warm-electron component would suppress all long axial wavelength ion instabilities through Landau damping. Two new and potentially dangerous instability mechanisms have been treated theoretically. At high densities new instability modes which result from a coupling of plasma oscillations analogous to sound waves with ion-cyclotron wave have been studied with a wide range of electron density, temperature, and ion anisotropy. These modes are calculated to propagate with very long wavelengths, and thus axial magnetic field gradients may favorably affect their growth. The second class of instabilities has a rather nonresonant character, has maximum growth, and is found to be produced by the presence of the hot-electron component. The experimental evidence of the fast-atom injection studies in the INTEREM mirror configuration shows stability of the accumulated ion plasma at densities of approximately one.
NSA

N70-14535# Oak Ridge National Lab., Tenn.
INJECTION AND ACCUMULATION: NEUTRAL INJECTION EXPERIMENTS (DCX-1.5)
R. J. Colchin, J. L. Dunlap, R. S. Edwards, L. A. Massengill, R. G. Reinhardt et al *In its* Thermonuclear Div. Jun. 1969 p 45–51 refs (See N70-14532 04-25)
Avail: CFSTI

Z-mode instabilities were studied in DCX-1.5. The results are compared with those from the PHOENIX 2 and ALICE experiments.
NSA

N70-14536# Oak Ridge National Lab., Tenn.
INJECTION AND ACCUMULATION: MULTIPLE-PASS EXPERIMENTS (DCX-2)
J. F. Clarke, J. S. Culver, S. M. De Camp, J. C. Ezell, J. E. Francis et al *In its* Thermonuclear Div. Jun. 1969 p 52–78 refs (See N70-14532 04-25)
Avail: CFSTI

The main features of the DCX-2 plasma behavior are now well understood. The dominant instability activity at the proton gyrofrequency and its harmonics was found to be due to a previously unrecognized instability (the modified negative mass instability). The electric fields produced act to spread the perpendicular energy of the initially injected protons and to heat cold protons produced from the background gas. The energetic plasma formed from the background gas. The energetic plasma formed from the background protons has very little energy parallel to the magnetic field and is the central peak distribution. The principal loss mechanism for the injected energetic particle distribution, called the side-lobe plasma, appears to be a low-frequency drift instability which carries these particles to the nearest obstacle, the injection duct. There is a correlation between this drift wave and the modified negative mass instability, and there may be a causal relationship between them. The drift instability occurs at a density well below the expected threshold. No losses other than by charge exchange have been found in the central peak distribution of particles, but it has not been confirmed that other loss processes do not exist.
NSA

N70-14537# Oak Ridge National Lab., Tenn.
ELECTRON CYCLOTRON HEATING
M. C. Becker, R. A. Dandl, H. O. Eason, P. H. Edmonds, A. C. Hengland et al *In its* Thermonuclear Div. Jun. 1969 p 79–97 refs (See N70-14532 04-25)
Avail: CFSTI

High-power microwave power sources for the ELMO facility and high-beta plasma dismagnetism in magnetic mirror machines are studied. Scattering and energy loss rates in radiations from hot-electron plasmas are investigated.
NSA

N70-14538# Oak Ridge National Lab., Tenn.
TURBULENT HEATING
R. V. Neidigh *In its* Thermonuclear Div. Jun. 1969 p 98–112 refs (See N70-14532 04-25)
Avail: CFSTI

The following topics were studied in relation to Burnout S: (1) plasma radial profile, (2) spectroscopic diagnostics, (3) energy fluctuations, (4) effect of helium impurity, (5) Doppler-broadened neutral emission, (6) magnetic field strength effects and heating efficiency, (7) hf correlation studies and rf effects, and (8) plasma losses induced by turbulent heating. The turbulent heating of electrons in mirror geometries is also discussed. NSA

N70-14539# Oak Ridge National Lab., Tenn.
PLASMA PHYSICS
In its Thermonuclear Div. Jun. 1969 p 113–144 refs (See N70-14532 04-25)
Avail: CFSTI

The following topics were studied: (1) Landau damping of electrostatic ion waves in uniform magnetic fields in xenon, (2) ion acoustic wave potential and density perturbations; (3) wavelength calculation for ion acoustic wave propagation, (4) dispersion relations for electrostatic ion wave propagation in magnetic fields, (5) transient and Langmuir boundary sheaths, (6) plasma production in magnetic fields, using electron guns and resonant microwaves, and (7) plasma stabilization and electron transport in Penning discharges. NSA

N70-14540# Oak Ridge National Lab., Tenn.
TOROIDAL MULTIPOLES
I. Alexeff, R. A. Dory, W. Halchin, M. Roberts, and W. L. Stirling *In its* Thermonuclear Div. Jun. 1969 p 145–159 (See N70-14532 04-25) refs
Avail: CFSTI

The following quadrupole experiments with a microwave-produced plasma are described: (1) comparison of dipole and quadrupole configurations, (2) comparison of first and second model quadrupole cavities, (3) electron temperature determination in the lambda = 3 cm, 200-W microwave plasma, (4) change in heating zone, (5) obstacle experiments, (6) effects of introducing supports, (7) nature of the decay of the 3-cm microwave plasma, and (8) effect of azimuthal electric field on microwave plasma. Preliminary observations on combined operation of the hydrated titanium washer gun and microwave heating are described. NSA

N70-14542# Oak Ridge National Lab., Tenn.
ENERGETIC PARTICLE INJECTORS FOR PLASMA PHYSICS EXPERIMENTS
R. C. Davis, R. R. Hall, G. G. Kelley, O. B. Morgan, Jr. *In its* Thermonuclear Div. Jun. 1969 p 176–181 refs (See N70-14532 04-25)
Avail: CFSTI

The following topics are discussed (1) space-charge neutralization, (2) ion source filaments, (3) solar wind experiment, and (4) hydrogen clusters. NSA

N70-14544# Oak Ridge National Lab., Tenn.
FUSION FEASIBILITY
In its Thermonuclear Div. Jun. 1969 p 203–212 refs (See N70-14532 04-25)
Avail: CFSTI

Plasma considerations for feasible controlled fusion are discussed. The following are also disucssed: (1) neutronics calculations and cost estimates for blanket assemblies, (2) diffusion process for removing tritium from blankets, and (3) the sputtering of Nb at 1000 C by 20-keV D(+). NSA

N70-14545*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODIFIED EXTRAORDINARY MODE IN MAGNETIZED PLASMAS WITH RELATIVE STREAMING
M. Bornatici and Kai Fong Lee (Catholic Univ. of Am.) Nov. 1969 15 p refs
(Grant NSF GK-4592)
(NASA-TM-X-63772; X-641-69-487) Avail: CFSTI CSCL 20I

It is shown that for a system composed of two identical electron streams in relative motion across a magnetic field, a new low frequency propagation band occurs for elliptically polarized waves propagating perpendicular to both the magnetic field and stream motion. No low frequency cutoff exists if the plasma frequency is higher than the electron cyclotron frequency. This modified extraordinary mode becomes unstable for wave numbers greater than some minimum value when the streaming velocity exceeds a certain threshold value. The case of two identical counterstreaming electron–ion plasmas is also discussed. Author

N70-14585# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
SUPERSONIC ELECTRIC ARCS IN SULFUR HEXAFLUORIDE
Charles E. Bond and Dwight N. Wickersheim Aug. 1969 24 p refs Prepared in cooperation with Illinois Univ.
Contract N00014-67-A-022-0005; Proj. SQUID)
(AD-693973; SQUID-TR-ILL-19-PU) Avail: CFSTI CSCL 21/2

Experimental observations are presented of supersonic convective electric arcs magnetically stabilized in sulfur hexafluoride. A long filamentary arc is reported for which it is found that the arc column, moving at Mach numbers from 1.3 to 6.6, slants across the electric field lines at angles such that the crossflow Mach number ranges from 0.8 to 3.0. The experimental apparatus is a thermionic rail accelerator. Observed values for the angle of slant are presented for three different temperatures of the preheated rail. The direction of slant was always such that the arc root at the heated rail led the remainder of the arc. For the range of conditions reported, the effective drag coefficient of the arc column, when based on the dimensions of the region of high luminosity, varied with crossflow Mach number in a manner similar to that of a solid cylinder. Author (TAB)

N70-14585# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF FINITE CONDUCTIVITY ON TWO-DIMENSIONAL PLASMA FLOWS IN A COAXIAL CHANNEL
K. V. Brushlinskii et al. 25 Apr. 1969 12 p refs Transl. into ENGLISH from Magnitn. Gidrodinamika (USSR), no. 2, 1967 p 31–34
(AD-695366; FTD-MT-24-434-68) Avail: CFSTI CSCL 20/9

Work was undertaken on the numerical resolution of the problem of a two-dimensional plasma flow with finite conductivity. The problem employs the steady-state operation of flow. Results pertain to the establishment and properties of flow depending upon conductivity and the magnetic field force. Author (TAB)

N70-14702# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Plasma Physics Research Lab.
LANGMUIR PROBE CURVES FOR ALKALI METAL MAGNETOPLASMAS
John C. Corbin, Jr. and John P. Oas Jul. 1969 25 p ref
(AD-695054; ARL-69-0108) Avail: CFSTI CSCL 20/9

Langmuir probe curves for a cesium plasma are given for selected values of density, temperature and probe size. A computer program is supplied which can be used to plot curves for other alkali metal plasmas. Author (TAB)

N70-14847*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
MODIFIED THEORY FOR CAVITY PERTURBATION MEASUREMENT OF PLASMA PARAMETERS
Y. S. Yeh and W. A. Saxton Oct. 1969 30 p refs
(Grant NGR-22-007-056)

(NASA-CR-107473; SR-5) Avail: CFSTI CSCL 20I

A cavity method, based on a first order perturbation theory, for the measurement of plasma density and electron collision frequency is proposed. Effects of fringing fields around a finite plasma column are considered, making it possible to remove the restriction that cavity dimension be much larger than the diameter of a circular cylindrical plasma tube. This greatly reduces the size of the cavity used normally for plasma diagnostics, and provides longitudinal resolution along the plasma column. Theory was experimentally verified with measurements on standard dielectric materials and on discharge plasmas whose electron density data were checked with Langmuir probes. Author

N70-14949# Air Force Systems Command, Wright-Patterson AFB, Foreign Technology Div.

STATIONARY PLASMA ACCELERATORS AND PROSPECTS FOR THEIR APPLICATION IN THERMONUCLEAR INVESTIGATIONS

A. I. Morozov 15 Apr. 1969 30 p refs Transl. into ENGLISH from Konf. po Issled. v Oblasti Fiz. Plazmy i Upravlyaemykh Termoyadernykh Reaktsii (Novosibirsk), 1968 p 1–24

(AD-694777; FTD-MT-24-447-68) Avail: CFSTI CSCL 18/1

The report describes the basic types of accelerating mechanisms which are operational in stationary plasma accelerators and gives a brief survey of theoretical, calculated and experimental investigations which were carried out by the author. The report is an analysis of 3 questions. (1) Basic principles and properties of stationary plasma accelerators. (2) The essence of stationary compression flows and feasibility of magnetoplasma compressors as thermonuclear devices. (3) Possible arrangements for transient thermonuclear reactors with external magnetic fields. TAB

N70-14957# Illinois Univ., Urbana. Coordinated Science Lab.

HEATING AND ENHANCED DIFFUSION DURING A BEAM-PLASMA INSTABILITY

H. Boehmer and M. Raether Sep. 1969 30 p refs

(Contract DAAB07-67-C-0199)

(AD-693807; R-429) Avail: CFSTI CSCL 20/9

An enhanced plasma diffusion is observed during the interaction of an electron beam of 0.1-1amp. current with a weakly ionized Ne-afterglow plasma. The parameter dependence of this effect is investigated in the electron density region 10 to the 10th to 13th power electrons/cc and the pressure range 0.01-0.1 Torr. Evidence is presented that this diffusion is due to heating of the plasma electrons partly by collisional damping of unstable plasma waves and partly by thermalization of secondary electrons emitted in ionizing collisions between beam electrons and neutral neon atoms. Author (TAB)

N70-15009# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A METHOD OF CONTINUOUS DIAGNOSIS OF THE ELECTRON CONCENTRATION IN PLASMA

O. F. Menshikh 22 Apr. 1969 9 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Sibirsk. Otd. Izv., Ser. Tekhn. Nauk (USSR), no. 1, 1968 p 39–41

(AD-694817; FTD-MT-24-13-69) Avail: CFSTI CSCL 20/9

A method for the continuous diagnosis of the electron concentration in plasma is based on a fast, automatically regulated system containing a tunable SHF generator which is tuned to the plasma frequency. The resolution of the system in the SHF band is of the order of a nanosecond, which is several orders of magnitude higher than the resolution obtainable with known automatic devices. Another advantage of the method is that it can be used to continuously perform exact, quantitative analyses of plasma formation and decay. TAB

N70-15044*# STD Research Corp., Pasadena, Calif.

DETERMINATION OF ENERGY-LOSS FACTORS FOR SLOW ELECTRONS IN HOT GASES Final Report, 28 Apr. 1966–15 Aug. 1969

S. T. Demetriades and C. D. Maxwell 15 Aug. 1969 162 p refs

(Contract NAS2-3580)

(NASA-CR-73400; STD-69-1) Avail: CFSTI CSCL 20I

The energy loss factor for slow electrons of essentially Maxwellian energy distribution was determined in a number of pure gases and gas mixtures as a function of electron temperature and gas enthalpy. The method used to make these measurements employed a high frequency (2.45 GHz) electric field to elevate the temperature of the free electrons above the temperature of the arc heated gas and a Langmuir probe to determine the electron temperature. Electron energy loss factors were obtained for pure argon, helium, and nitrogen and binary mixtures of nitrogen, oxygen, carbon monoxide, carbon dioxide, nitric oxide and helium with argon. The mixture results were analyzed by means of a single mixture rule and the energy loss factors for the pure constituent gases were derived. Author

N70-15074*# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.

A SHORT, CYLINDRICAL ANTENNA AS A DIAGNOSTIC PROBE FOR MEASURING COLLISION FREQUENCIES IN A COLLISION-DOMINATED, NON-MAXWELLIAN PLASMA

L. D. Scott and B. Rama Rao Mar. 1969 39 p refs

(Grant NGR-22-007-056)

(NASA-CR-107454; SR-3) Avail: CFSTI CSCL 20I

Investigations were made to determine the effects of interparticle collisions on the antiresonant impedance characteristics of an electrically short, cylindrical antenna in the vicinity of the plasma frequency of an isotropic non-Maxwellian plasma. The dependence of the electron–neutral collision frequency on the electron energy has been taken into account. The use of this antenna as a diagnostic probe for measuring electron–neutral collision frequency and electron density has been investigated. Electron–neutral collision frequencies for helium measured by this technique are in good agreement with theoretical results calculated from the collision cross section data. Author

N70-15076*# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.

EXPERIMENTAL INVESTIGATIONS ON THE IMPEDANCE BEHAVIOR OF A SHORT, CYLINDRICAL ANTENNA IN A LOSSY MAGNETOPLASMA

Bharathi Bhat and B. Rama Rao Feb. 1969 28 p refs

(Grant NGR-22-007-056)

(NASA-CR-107453; SR-2) Avail: CFSTI CSCL 20I

Experimental investigations were made to determine the behavior of a short, cylindrical antenna at the refractive index resonance and cut-off regions of a cold, lossy magnetoplasma. The static magnetic field is oriented parallel to the axis of the antenna. The experimental results were compared with the theories proposed by several authors. Of particular interest is the series of resistance maxima noticed at discrete frequencies corresponding to the cut-off and upper-hybrid resonance conditions. The significance of these results in interpreting the maxima in cosmic noise intensities and the resonance spikes observed in the ionograms of top-side sounder satellites has been discussed. The possibility of using such an antenna as a diagnostic probe for measuring electron densities of over-dense magnetoplasmas has been indicated. Author

N70-15115 Case Western Reserve Univ., Cleveland, Ohio.

ELECTRICAL CONDUCTION FROM A COLD ELECTRODE TO A SUPERSONIC PLASMA

Richard Earl Schwirian (Ph.D. Thesis) 1968 156 p

Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-9436

Numerical solutions are obtained for the quasi-one dimensional flow of electric current from a flat plate probe to a shock-heated argon plasma. The governing equations are derived by taking moments of the Boltzmann equation. The moments considered are the atom, ion and electron continuity, momentum and heat flux moments together with atom and electron energy moments. Ion and atom temperatures are assumed to be equal so that an ion energy equation is not required. The gas is assumed to be slightly ionized, thereby allowing the atom temperature distribution to be calculated independently. Calculations are performed for typical shock tube conditions. The effects of current density, free stream temperature and distance from the leading edge on electron number density and temperature profiles are discussed. Finally, computations of current density-voltage characteristics are made with and without secondary emission effects included and presented graphically. Dissert. Abstr.

N70-15128*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
AN INVESTIGATION OF TRANSIENT MAGNETIC FIELDS IN A PLASMA TRAPPED IN A DIPOLAR MAGNETIC FIELD
R. H. Garvey 10 Dec. 1969 52 p refs
(Grant NGL-39-009-003)
(NASA-CR-107551; SR-345) Avail: CFSTI CSCL 20I

Instability discharges accompanying steady-state plasmas trapped in a steady-state magnetic field are described and studied. It is possible that these transient discharges may be similar to certain aspects of auroral phenomena. Spatial mappings of the transient magnetic fields associated with these instabilities are presented, along with qualitative discussions concerning the origins of the instabilities. Author

N70-15129*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
PLASMA OSCILLATIONS IN A SPHERICAL, MAGNETIZED, COLD CATHODE DISCHARGE
P. E. Schmidt and R. G. Quinn 20 Oct. 1969 73 p refs
(Grant NGL-39-009-003)
(NASA-CR-107550; SR-341) Avail: CFSTI CSCL 20I

Plasma oscillations of very low frequency have been found in a cold cathode DC discharge, where the cathode consists of an uniformly magnetized sphere. Under certain pressure and discharge conditions the plasma becomes trapped in the magnetic dipole field of the cathode. Under these conditions plasma oscillations occur. The plasma oscillations have been studied in detail with respect to the two terminal characteristic of the device. It is found that the frequency of the plasma fluctuations decreases with increasing current, gas pressure, ion mass, and decreasing voltage. No dependence of the frequency on the external series resistance or magnetic field is noticeable. The oscillations are rich in harmonics. In addition to the fundamental, the 2nd and 3rd harmonic have been studied. Experimentally it is found that f = A R sub DC, where f is the frequency, A a constant dependent upon pressure and R sub DC is the ratio of the DC voltage between the electrodes and the DC discharge current. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-14149# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DYNAMIC THEORY OF INTERFERENCE OF X-RAYS FOR A CRYSTAL OF FINITE DIMENSIONS
A. G. Akritov et al 9 May 1969 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Fiz. (Yerevan), v. 1, 1966 p 3–10
(AD-695183; FTD-HT-23-d96-68) Avail: CFSTI CSCL 20/2

An expression is derived for the relative intensity of x-ray waves reflected from a finite-dimension crystal (nonabsorbing crystal). A theoretical curve is given of the dependence of the max. relative intensity on the number of atomic planes for a calcite crystal. No complete reflection occurs at any incidence angle. Author (TAB)

N70-14154*+ Illinois Univ., Urbana. Coordinated Science Lab.
ONE-ELECTRON AND PHONON-ASSISTED TUNNELING IN N GE SCHOTTKY BARRIERS
L. C. Davis and F. Steinrisser Jun. 1969 42 p refs
(Grant NsG-228-62; Contracts DAAB-07-67-C-0199; DA-31-124-ARO(D)-114)
(NASA-CR-107355; AD-688837; Rept-419) Avail: CFSTI CSCL 20/12

The experimental tunneling conductance of metal - Ge contacts is compared to the predictions of the one-electron Schottky-barrier model in which all parameters are determined from experiments other than tunneling. Agreement is found in the magnitude and the shape of conductance vs bias curves for vacuum - cleaved, Sb-doped Ge units. The qualitative features of the As-doped units are also in agreement, but a discrepancy in magnitude exists. Substantially larger conductance is found in air-cleaved junctions than in vacuum cleaved junctions. Capacitance measurements reveal that the barrier height for air-cleaved junctions is V sub b = 0.51V whereas V sub b = 0.63V for vacuum-cleaved junctions. Pronounced step increases in the conductance due to phonon-assisted tunneling occur at eV plus or minus H omega where h omega is the energy of a Ge phonon at the Brillouin zone boundary along the <111> direction. Structure is clearly observed at all four phonon energies (TA, LA, LO, TO). The magnitude of the LA phonon-assisted tunneling is accounted for in a theoretical calculation bases upon a mechanism suggested by Kleinman to explain similar phenomena in Ge p-n junctions. The strength of the TA and LO phonon-assisted tunneling also appear to be in reasonable agreement with qualitative considerations, but the observed to phonon-assisted tunneling is stronger than expected. Author (TAB)

N70-14189# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF DISLOCATION DENSITY ON THE RADIATION EXPANSION OF THE VOLUME OF CRYSTALS
D. O. Kalnin et al 3 Apr. 1969 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk Latv. SSR, Ser. Fiz. i Tekhn. Nauk (Riga), no. 6, 1966 p 101–102
(AD-694802; FTD-HT-23-1283-68) Avail: CFSTI CSCL 18/8

The effect of the dislocation density on the expansion of the volume of LiF during irradiation in a reactor was investigated. The LiF crystals were grown in a vacuum and etched in an aqueous solution. The dislocations have no significant effect on the radiation expansion. TAB

N70-14209# Technische Hogeschool, Eindhoven (Netherlands).
SI-GE ISOTYPE HETEROJUNCTIONS
Christianus Johannes Marinus van Opdorp (Ph.D. Thesis) 28 Oct. 1969 107 p refs Submitted for publication
Avail: CFSTI

A heterojunction is a junction between two different monocrystalline semiconductor materials. Heterojunctions can be separated into isotype and anisotype groups, in which the two semiconductors have equal and opposite conductivity, respectively. Some general remarks on heterojunctions and the reasons for interest in them are given. A critical survey is made of published models for energy-band diagrams and transport mechanisms for both types of heterojunctions. One of these models, the double-Schottky-diode model for isotype heterojunctions, is analyzed in detail. Preparation of and measuring techniques for Si-Ge isotype

heterojunctions are described. In order to localize the various excitation mechanisms contributing to the photoresponse, a new technique is discussed which consists of geometrical scanning of the photoresponse with an extremely narrow monochromatic line of light. Experimental results are compared with calculations and good quantitative agreement is obtained for the n-n heterojunctions in a restricted voltage interval. The analysis of the photoresponse leads to introduction of the concept of 'interface valence-band emission.' R.B.

N70-14228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
THE STRUCTURE OF TH-RE ALLOYS
T. A. Badaeva and L. I. Dashevskaya 7 Apr. 1969 15 p refs Transl. into ENGLISH Fiziko-Khimiya Splavov i Tugoplavkikh Soedinenii S Toriem i Uranon, (Russian), 1968 p 15–20
(AD-694781; FTD-MZ-24-63-69) Avail: CFSTI CSCL 20/12

The report discusses the structure of alloys of the Th-Re system by methods of roentgen-phase analysis. The microstructure and the measurements of hardness are considered. It is shown that ThRe(subscript 2) will be formed by peritectic reaction and is in eutectic equilibrium with thorium; the composition of the eutectic corresponds to 14.9 at. percent Re at 1400 degrees C. The content of ThRe(subscript 2) does not have a region of extent. Thorium and rhenium will not form noticeable regions of solid solutions. TAB

N70-14236# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
STRAIN SENSITIVITY IN INDIUM ANTIMONIDE FILMS
N. N. Sirota and E. I. Bolvanovich 30 Jan. 1969 9 p refs Transl. into ENGLISH from Akad. Nauuk BSSR, (Minsk), v. 7, no. 10, 1967 p 891–892
(AD-694844; FTD-HT-23-716-68) Avail: CFSTI CSCL 20/12

The stress effect was measured and the effects of electron concentration and film thickness on stress-sensitivity were studied in InSb thin films deposited by flash evaporation of commercial InSb powder on a heated glass substrate. Concentration of electrons varied by autodoping within 5 x 10 to the 16th power to 3 x 10 to the 18th power electrons/cc. Electrical characteristics of the films of varied thickness (0.3-1.9 micrometers) were measured and the data were tabulated. Author (TAB)

N70-14295# Atomic Energy of Canada, Ltd., Chalk River, (Ontario). Nuclear Labs.
HIGH RESOLUTION ELECTRON MICROSCOPY
F. Brown *In its* Mater. Res. at Chalk River Oct. 1969 p 4–7 refs (See N70-14293 04-17)
Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

Advanced techniques in electron microscopy have enabled the atomic planes of crystals to be resolved. Details of the structure in and around various types of defects have been studied and, as examples, photographs of edge and screw dislocations are presented. Author

N70-14615# Royal Radar Establishment, Malvern (England).
PREPARATION AND PROPERTIES OF GUNN OSCILLATORS
H. Salow et al [1969] 28 p Transl. into ENGLISH from German report FTZ-A-463-TBr-1
(RRE-Trans-203; TIL/OT/9033; FTZ-A-463-TBR-1) Avail: CFSTI

The preparation and properties of Gunn oscillators are described. Various materials and different production methods are tested for nonrectifying contacts of GaAs elements. Vacuum evaporated tin layer or tin ball contacts supply the best results. Gunn oscillators for S and X band were constructed and their frequency behaviour described; high frequency outputs of up to 6 watts at 3 GHz and an efficiency of 1.5% were achieved for pulse operation. Author

N70-14616# Royal Radar Establishment, Malvern (England).
EUTECTIC In-Sb-Mg SUB 3 Sb SUB 2
A. Muller et al [1969] 17 p refs Transl. into ENGLISH from Z. Naturforsch. (Tuebingen), no. 21a, 1966 p 555–561
(RRE-Trans-191; TIL/OT/9019) Avail: CFSTI

InSb and Mg3Sb2 form a laminated structural eutectic. The eutectic concentration exists at 2.2 weight percent Mg3Sb2. These laminae coalesce in eutectic structure with 111 planes of InSb. There is reason to believe that the composition plane of Mg3Sb2 (0001)-planes are present in the lattice of MgSb. The dependence of the spacing of the laminae on the rate of the crystalline growth was investigated. Author

N70-14639# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ANGULAR DISTRIBUTION OF HIGH-ENERGY ELECTRON BREMSSTRAHLUNG ON A DIAMOND CRYSTAL
R. O. Avakyan et al 26 Mar. 1969 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Arm. SSR (Yerevan), v. 45, no. 1, 1967 p 3–7
(AD-695924; FTD-HT-23-1209-68) Avail: CFSTI CSCL 20/2

The angular distribution of 1-Gev photons due to bremsstrahlung of 6-Gev electrons on a diamond crystal is given. The beam direction was selected at an angle of 1.55 milliradians relative to the (110) crystal axis; the angle between (110), and (110), (001) planes was taken as zero. Calculations indicate that for each specified reciprocal lattice vector the quanta angular distribution possesses a specific shaped character. Calculations also give the conditions under which it is possible to separate an individual line in the bremsstrahlung spectrum on the crystals. The results of such calculations are indicated for 2 bremsstrahlung collimation spectra. Also calculated is an expression for the differential cross sections of pairs created in the bremsstrahlung process. Author (TAB)

N70-14657*# Tyco Labs., Inc., Waltham, Mass.
DIRECTIONAL SOLIDIFICATION OF MULTICOMPONENT SUPERCONDUCTING SYSTEMS UNDER ZERO G CONDITIONS
J. T. A. Pollock and Fritz Wald *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 135–145 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 20L

Metallurgical microstructure plays a major role, through its influence on magentic flux pinning, on the critical current density of superconducting materials. It has been found in technological practice that the capabilities of superconducting materials, as measured in short length samples, are rarely realized when long lengths of the same material are wound in a solenoid. This degradation has been attributed to magnetically induced thermal instabilities. A method is proposed for the preparation of stable superconducting cables comprising a filamentary phase of one superconducting in a matrix of another. This is to be achieved by directional solidification of appropriate superconducting systems under 0 g conditions. Author

N70-14667*# Westinghouse Electric Corp., Pittsburgh, Pa.
ZERO GRAVITY CRYSTAL GROWTH
Robert Mazelsky *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 297–305 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 20B

This talk briefly reviews the principles of crystal growth and describes the different techniques that are regularly used. The advantages and problems of the various techniques are characterized. It is shown that for at least the preliminary attempts at crystal growth, solution growth has the advantage over other techniques in that it will require the minimum amount of operator

time, lower temperature operation, and will not require unusual safety requirements. An outline of the projected experiment in solution growth at zero gravity is described. Author

N70-14668*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TECHNIQUES FOR CHARACTERIZATION AND EVALUATION OF ZERO-GRAVITY GROWN GALLIUM ARSENIDE
Arun P. Kulshreshtha, T. Mookherji, and G. M. Arnett *In its* Space Process. and Manuf. Meeting 21 Oct. 1969 p 306-322 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 20L

Recent proposals concerning the advantages of purifying gallium arsenide and growing its single crystals in zero-gravity environment have led to an investigation into the possibilities of characterizing this material. The present paper discusses briefly several modern techniques which could be utilized to determine the ultratrace impurities and the dislocation-type imperfections and impurities influencing the electronic properties of gallium arsenide. Author

N70-14674*# North American Rockwell Corp., Thousand Oaks, Calif.
CRYSTAL GROWTH FROM MELTS IN 0-G ENVIRONMENT
L. D. Fullmer and R. M. Housley *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 383-389 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 20B

The value of highly perfect single crystals to technology is discussed. Many potentially useful crystals which cannot be grown on earth because the melt cannot be contained could be grown from containerless melts in 0-g. Very desirable increases in perfection of other crystals currently being used could probably be achieved in 0-g. The factors limiting perfection and their relation to gravity are discussed. Different techniques of growth in 0-g are discussed and very versatile crystal pulling apparatus which combines the advantages of float zone refining and Czochralski growth is schematically described. Author

N70-14676*# Alabama Univ. Research Inst., Huntsville.
SINGLE CRYSTAL GROWTH FROM MELT UNDER SPACE ENVIRONMENT
Upendra Roy *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 403-421 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 20B

A brief outline of the methods of single crystal growth from melt under 1-g is presented and their relative merits discussed. The role of near 0-g environment and other practical parameters important to the growth of perfect single crystals is considered. The effect of interface shape, high-g, gamma-ray irradiation and electromagnetic body force is reviewed. The experiment to study the growth kinetics under various equivalent gravity fields is discussed in more general terms and a partial list of the candidate materials suitable for space crystal growth is presented. Author

N70-14677*# Alabama Univ. Research Inst., Huntsville.
AN ANALYTICAL EXPERIMENTAL STUDY OF POSSIBLE EFFECTS OF GRAVITY ON CRYSTAL WHISKERS
Jack H. Davis *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 423-433 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 20B

This paper reports on the progress of analytical and experimental efforts to determine if a 1-g environment has any effect on whisker growth. It is found analytically that the best quality whiskers are the ones most likely to be destroyed by gravity. A centrifuge experiment is set up to check this idea experimentally. The centrifuge is also being used to measure directly the effect of increased gravity on crystal growth by vapor deposition where convection is important. Author

N70-14678*# Lockheed Missiles and Space Co., Huntsville, Ala.
GRAVITY-DRIVEN AND SURFACE TENSION-DRIVEN CONVECTION IN SINGLE CRYSTAL GROWTH
Philomena G. Grodzka *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 434-447 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 20B

Analytical and mathematical studies of the floating-zone and the Czochralski techniques of growing single crystals are being conducted. The objective of these studies is to elucidate the role of convection in single crystal growth. Gravity-driven and surface tension-driven convection and possible couplings between these two convective modes will eventually be incorporated into the analyses. The analyses are expected to provide a basis for predicting the effects of a zerogravity environment on crystal growth. Author

N70-14817# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid States Physics
SOME MEASURABLE CONSEQUENCES OF FLUCTUATIONS OF THE ORDER PARAMETER IN SUPERCONDUCTORS Technical Report
Vinas Ambegaokar Sep. 1969 22 p refs Presented at the Conf. on the Sci. of Superconductivity, Stanford Univ., 1969
(Contract N00014-67-A-0077)
(AD-695801; TR-8) Avail: CFSTI CSCL 20/12

A general review is given of fluctuations in superconductors and the temperature region in which critical fluctuations occur. It is pointed out that the small parameter governing the critical region does not also generally control the observability of fluctuations in superconductors. This remark is illustrated by elementary and phenomenological discussions of the fluctuation contribution to the electrical conductivity and the magnetic susceptibility. Finally a brief sketch is given of a microscopic calculation of the contribution of fluctuations to the magnetic susceptibility. Author (TAB)

N70-14827# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LOW-TEMPERATURE LUMINESCENCE ANOMALIES OF ANTIFERROMAGNETIC CRYSTALS
V. V. Eremenko et al 31 Jan. 1969 6 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 11, no. 8, 1966 p 902-903
(AD-693815; FTD-HT-23-830-68) Avail: CFSTI CSCL 20/2

Low temperature luminescence anomalies of MnF2 crystals were studied. The luminescence spectra were studed by means of a prism monochromator. The intensity of luminescence was recorded by the EEU-17A photomultiplier. The three optical transitions in MnF2 were studied by means of the monochromatic light. The phonon intensity decreases rapidly with a decrease in temperature from 77 to 20 degrees K. It is proposed that the luminescence anomalies observed in antiferromagnetic crystals are associated with the condensation of local magnetic vibrations. TAB

N70-14869# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
THE THEORY OF RAMAN SCATTERING BY IMPURE CRYSTAL. THE RESONANCE CASE
I. Yu. Tekhver 3 Dec. 1968 19 p refs Transl. into ENGLISH from Akad. Nauk Estonsk. SSR, Inst. Fiz. i Astron. Tr. (Tallinn), no. 32, 1967 p 31-45
(AD-695883; FTD-HT-23-999-68) Avail: CFSTI CSCL 20/12

The resonance Raman spectrum of an impure crystal is analyzed in the adiabatic and Condon approximations with allowance for the anharmonicity of the lattice vibrations but neglecting variations

in force constants in various electron states. The spectral intensities are calculated for two cases: (1) the incident light frequency omega being in the region of pure-electron transition and (2) omega falling in the region of the phonon wing, assuming the Stokes-shifts are appreciable. In the latter case, a quasi-linear structure of the spectrum may be observed, which makes it possible to use the resonance Raman spectra for studying the dynamics of impurity centers with appreciable Stokes-shifts. TAB

N70-14971# Ohio State Univ. Research Foundation, Columbus. Electronic Materials and Devices Lab.
DIFFUSION AND LUMINESCENCE OF RARE EARTHS IN CADMIUM SULFIDE Interim Technical Report
Dexter G. Girton (Ph.D. Thesis) Jun. 1969 154 p refs
(Contract DAHC04-67-C-0043)
(AD-693887; RF-2419-TR-69-1; AROD-6835-2-E) Avail: CFSTI CSCL 20/12

The technique of diffusion is shown to solve the major problems of producing rare earth doped CdS. In this method, an undoped CdS crystal, excess S (or Cd), and 5 mg of rare earth metal were sealed in a 3.6 cc. quartz ampoule at about 2 x 10 to the 5th power torr. Diffusions were performed with excess S for pressures ranging from 3.3 atm. to 33 atm. and temperatures ranging from 800C to 1050C, and with 6 atm. excess Cd at 960C. Diffusions were also performed with ZnSe crystals, excess Se, and 5 mg rare earth. The presence of rare earths in the diffused CdS (and ZnSe) samples was detected by observing the photoluminescent emission at 77K. The emission Pr, Nd, Ho, Er, Tm and Yb in CdS, and Ho, Er, Tm, and Yb in ZnSe has been observed and the spectra are shown. For given temperature, time, and chalcogen pressure the spectral characteristics were very reproducible from run to run, and the emission intensity for Nd, Er, and Yb in CdS was as high or higher than the best vapor phase doped crystals we have grown. A luminescent profile technique has been developed which measures the rare earth luminescent intensity as a function of depth from the surface of diffused samples. Photoluminescence measurements of Yb in CdS as a function of depth gave a profile which was neither a Gaussian nor complementary error function. Part of the profile appears to arise from a fast component of the diffusion and the other part from a slow diffusing component. Author (TAB)

N70-15024# Stanford Univ., Calif. Electronics Labs.
ELECTRONICS LABORATORIES Quarterly Status Report, 1 Apr. - 30 Jun. 1969
1969 87 p refs
(Contract Nonr-225(83))
(AD-693998; SU-SEL-69-036; QSR-114) Avail: CFSTI CSCL 5/2

Contents: Plasma physics and quantum electronics; Radioscience; Solid-state electronics; Systems theory; and Digital systems. TAB

N70-15061# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
SURFACE AND ENVIRONMENT-SENSITIVE MECHANICAL BEHAVIOR
Albert R. C. Westwood and R. M. Latanision (NBS) Jul. 1969 160 p refs
(Contract Nonr-4162(00))
(AD-694058; RIAS-TR-69-9c; TR-12) Avail: CFSTI CSCL 20/2

The influences of surface structure and environment on the mechanical behavior of crystalline inorganic solids are reviewed and possible mechanisms discussed. In particular, the various roles of such factors as the atomic, electronic, and defect structures of the near-surface regions, the presence of adsorbed surface-active species, alloyed layers, oxide films, gaseous or liquid environments, etc. are considered in connection with the Roscoe, Rebinder, and Joffe effects, liquid-metal embrittlement, complex-ion embrittlement, hydrogen embrittlement, and other phenomena. Author (TAB)

N70-15067# Minnesota Univ., Minneapolis. Dept. of Chemistry.
ELECTRONIC PROPERTIES OF INORGANIC SOLID SOLUTIONS Final Report, 16 Mar. 1965 - 30 Jun. 1969
Lawrence E. Conroy 1 Oct. 1969 5 p
(Contract DA-ARO(D)-31-124-G661)
(AD-695697; AROD-5532-3-C) Avail: CFSTI CSCL 20/2

A summary is given of publications and results of research which included synthesis for tungsten bronze solutions, crystal growth of metal disulfides (TiS2, ZrS2, HfS2, SnS2), and the growth of single crystals of WO2 and MO2. TAB

N70-15167*# Maryland Univ., College Park.
RATIO OF SURFACE TO BULK NUCLEATION CRITICAL FIELDS FOR PURE SUPERCONDUCTORS IN THE NON-LANDAU GINZBURG REGION
Chia-Ren Hu (Ph.D. Thesis) Jun. 1968 161 p refs
(Grants NGL-21-002-008; AF-AFOSR-735-65; AF-AFOSR-68-1459)
(NASA-CR-107572) Avail: CFSTI CSCL 20L

The ratio of surface to bulk nucleation critical fields for semi-infinite pure superconductors separated from a vacuum or an insulator by a specularly reflective plane boundary, is studied for both T congruent to 0 K and near the Landau - Ginzburg region. Gor'kov's microscopic formulation of superconductivity theory is employed. A generalized image method is first developed to obtain the normal electron temperature Green's function pertaining to the given sample geometry. The appropriate linearized gap equation for such a sample is then derived. For T = 0 K, this linear homogeneous integral equation is then solved by a variational method using a gaussian as the trial wave function. In the first approach, the conventional assumption that the pair wave function is everywhere slowly varying inside the sample is made. It leads to a simultaneous, microscopic derivation of the linearized Landau - Ginzburg equation and its supplementary boundary condition, for samples with a boundary. This approach is shown to be not self-consistent for temperatures below the Landau - Ginzburg region. The second arpproach, allowing for the rapidly varying nature of the pair wave function near the sample surface, is then used. Author

N70-15201*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF BIAS LIGHT AND HEAT TREATMENT ON THE SPECTRAL RESPONSE OF CADMIUM SULFIDE THIN FILM PHOTOVOLTAIC CELLS
Henry W. Brandhorst, Jr., Rose L. Schalla, Andrew E. Potter, Jr. and Louis Rosenblum Washington Jan. 1970 21 p refs
(NASA-TN-D-5521) Avail: CFSTI CSCL 10B

Red and blue bias lights and heat treatment have complex effects on the spectral response of cadmium sulfide solar cells. These effects were studied and are interpreted in terms of a model involving a photoconductive layer with a high dark resistance. In darkness or in red (0.9 micrometers) light, this layer causes losses in the externally observed current both by its resistance and by trapping and recombination processes. Blue light (0.5 micrometers) eliminates these losses. This layer is presumably formed in the junction region of the cell by diffusion of copper into the cadmium sulfide during heat treatment. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-14401*# TRW Systems, Redondo Beach, Calif.
EXTEND THE DESIGN CRITERIA FOR THE COAXIAL PINTLE INJECTOR TO HIGHER CHAMBER PRESSURES AND

TO GASEOUS FUEL Monthly Progress Report, 2 - 25 Jul. 1969
W. A. Carter 25 Aug. 1969 16 p refs
(Contract NAS3-13307)
(NASA-CR-107381 ; MPR-1) Avail: CFSTI CSCL 21D

Design analysis of the coaxial pintle injector and passively cooled thrust chamber is discussed. The use of a fluorine liquid-oxygen (FLOX) and gaseous propellant combination in the coaxial pintle injector was investigaged. The effects of geometry, momentum ratios, velocities, inpingement angles, and pressure drops are also included in the analysis. J.M.C.

N70-14708*# Stanford Research Inst., Menlo Park, Calif.
PHYSICAL PROPERTIES OF LIQUID OXYGEN DIFLUORIDE AND LIQUID DIBORANE: A CRITICAL REVIEW UPDATED
W. E. Tolberg and Derek Tegg 30 Sep. 1969 48 p refs Prepared for JPL Revised
(Contracts NAS7-100; JPL-951581; SRI Proj. PRD-6063)
(NASA-CR-107434; SRI-951581-4A) Avail: CFSTI CSCL 21I

This report includes a complete survey of the available literature on the physical and thermodynamic properties of liquid oxygen difluoride and liquid diborane up to September 1, 1969. The report contains all information previously published July 1, 1967, in Stanford Research Institute Report No. 951581-4 with very minor changes in literature references. The survey has shown that no new work on physical properties has been reported from July 1, 1967 to the present. Recommendations for further work were included in the earlier report and these have been restated along with recommendations for more studies on liquid OF2 and liquid B2H6. Author

N70-15490# California Inst. of Tech., Pasadena. Fire Flight Sciences Lab.
FAILURE CRITERIA FOR VISCOELASTIC MATERIALS
W. G. Knauss Dec. 1969 11 p
(Grant NGL-05-002-005)
(NASA-CR-107482; GALCIT-SM-69-12) Avail: CFSTI CSCL 21I

Classical energy release calculations and the assumption that crack propagation always occurs along the direction of its own axis are challenged by mathematical analysis and tests on solid propellant fuels. In this case, the general problem of a crack which does not propagate in the direction of its own axis, and energy criterion applied to the moment when maximum release equals the surface energy, give results which contradict all experimental evidence. Internal fracture and dewetting processes are demonstrated to cause the relaxation process in solid propellants. In addition, the mechanics of internally fracturing solids is substantiated for describing the major deviations of propellant behavior from linearly viscoelastic behavior. Creep tests constructed to determine those parameters which control the internal fracture history are reported. M.H.E.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-14178# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESPONSE IMPROVEMENT AND TRANSIENT AUGMENTATION OF TRANSPORT GAS-TURBINE ENGINES BY INJECTION OF WATER AND ADDITIONAL FUEL INTO COMBUSTION CHAMBER
Yu. I. Freiman 3 Feb. 1969 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro (Moscow), no. 11, 1967 p 92 - 96
(AD-694799; FTD-HT-23-901-68) Avail: CFSTI CSCL 21/5

A quantitative analysis of a method for shortening the pick-up time of a gas turbine engine is presented. This method involves the injection of water and supplementary fuel into the combustion chamber of the engine. Curves are included showing the turbocompressor takeoff rate as a function of various nozzle rates of fuel-water injection and of the relationship of the lines of joint work of the turbine and compressor relative to the pumpage limit with fuel-water injection. Data are also given which show the percentage of nominal power attainable with injection. The proposed method may be implemented at the cost of increasing the fuel consumption rate by 2--2.5%; with suitable nozzle equipment the engine pickup rate may be doubled. This paper was presented by Professor Ye. G. Shumskiy of the Moscow Automobile Mechanics Institute. Author (TAB)

N70-14186*# Aerotherm Corp., Palo Alto, Calif.
A STUDY OF THE BOUNDARY FLOW IN A ROCKET COMBUSTION CHAMBER. PART 1: SUMMARY Final Report
Ronald D. Grose 22 Sep. 1969 62 p refs Prepared for JPL
(Contract NAS7-463)
(NASA-CR-107313; FR-69-51-Pt-1) Avail: CFSTI CSCL 21H

Boundary flow chemical composition and heat flux data from a hydrazine-nitrogen tetroxide rocket motor are presented. The spatial distribution of these data is related to certain injector design characteristics and to the ablation response produced by the injector in a Refrasil--phenolic chamber. Theoretical confirmation of the composition, heat flux and ablation data are made. Sampling system, experimental technique, and sample chemical analysis technique developments are also presented. Author

N70-14215*# Aerotherm Corp., Palo Alto, Calif.
A STUDY OF THE BOUNDARY FLOW IN A ROCKET COMBUSTION CHAMBER. PART 3: DATA REPORT Final Report
R. D. Grose and V. I. Nicholson 22 Sep. 1969 214 p refs Prepared for JPL
(Contract NAS7-463)
(NASA-CR-107308; FR-69-51-Pt-3) Avail: CFSTI CSCL 20H

Liquid rocket motor chamber boundary flow chemical and heat transfer data are reviewed for a hydrazine-nitrogen tetroxide propellant system. The axial distribution of the species mole fractions determined in the flasks by the mass spectrometer for given injector positions are presented, as well as distribution of the three principal atoms present, hydrogen, nitrogen, and oxygen; and radial distribution of the principal atom fractions. Significant variations in heat flux were observed. Difficulties in the data reduction procedure and irregularities in the boundary condition make the accuracy of the absolute level of the heat flux uncertain. Motor and test stand system parameter data are summarized along with parameter effects on chemical and heat flux data. Results are presented in tabular form. J.A.M.

N70-14262*# TRW, Inc., Cleveland, Ohio. Materials Lab.
REINFORCED OXIDE THROAT INSERT DEVELOPMENT
F. T. Lally and D. P. Laverty NASA. Lewis Research Center 31 Dec. 1968 155 p
(Contract NAS3-11177)
(NASA-CR-72673; TRW-ER-7327) Avail: CFSTI CSCL 21H

This program was aimed at developing improved wire reinforced zirconia nozzle inserts for liquid propellant rocket application. The program studied zirconia matrix materials, refractory metal reinforcing wires, and the variables associated with consolidating these constituents into a composite. Thermal shock tests, other thermal and mechanical tests, and rocket exhaust oxidation studies identified an optimized composite material for fabrication of 3 inch

throat diameter inserts. These inserts were evaluated in a rocket engine by a test firing sequence totalling 700 seconds exposure and including several restarts. They performed successfully with no throat erosion and without thermal shock failure. Author

N70-14284# National Aerospace Lab., Tokyo (Japan).
THRUST MAGNITUDE CONTROL OF SOLID ROCKET MOTORS: CHARACTERISTIC ANALYSIS AND SMALL MOTOR TESTS
Tomifumi Godai, Yoshinori Yuzawa, Katsuya Ito, and Hisao Nishimura 1969 14 p refs In JAPANESE; ENGLISH summary
(NAL-TR-177) Avail: CFSTI

The thrust magnitude control of solid propellant rocket motor is investigated, analytically and experimentally, for demonstrating the feasibility of thrust magnitude and stop – restart control of solid rocket motors and for analyzing its steady state characteristics. An analysis of experimental results indicates that the injection of combustion gas generated from the micro solid propellant gas generator into the primary solid rocket motor increases the chamber pressure; and, that high pressure exponent in burning rate rule and high deflagration pressure limit of propellant are essential for the thrust termination and restart capability. It also shows that the higher characteristic exhaust velocity of the injectant compared with that of combustion gas of the primary motor improves the thrust magnitude control capability. Comparison of the analytical results with experimental data available from firings of 2 and 4 inch diameter motors is good. Two types of pressure time traces are demonstrated, dual thrust and thrust termination types, by varying a propellant surface to throat area ratio and a flow rate ratio of injectant to combustion gas of primary motor. Author

N70-14323# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEVERAL KINDS OF ATOMIC ROCKETS
Shu Ch'i 30 Apr. 1969 8 p refs Transl. into ENGLISH from Hang K'ung Chih Shih (Peking) no. 3, 1960 p 17–18
(AD-694750; FTD-HT-23-838-68) Avail: CFSTI CSCL 21/6

The author discusses five types of atomic powered rockets: engines utilizing the atomic energy produced by atomic nuclear fission reactions; engines utilizing the direct heating of propellants by fission materials in the combustion chamber; engines utilizing the acceleration of ions by electric or magnetic fields; engines with ballistic tubes; and engines utilizing electric arc to heat propellants. Author (TAB)

N70-14357# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AVIATION ENGINES
V. A. Tyutyunov et al 9 May 1969 72 p Transl. into ENGLISH from Aviats. Dvigateli (Moscow), 1964 p 5–14, 16–18, 56–57, 170–178, and 328–353
(AD-695912; FTD-MT-24-286-68) Avail: CFSTI CSCL 21/5

The book presents basic problems in the theory and design of aircraft engines. The book is intended as a textbook for students in aviation aircraft building techniques and can be useful to technicians of the aviation industry. Author (TAB)

N70-14396# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION AND DESIGN OF THE COMBUSTION CHAMBER OF A GAS TURBINE (SELECTED ARTICLES)
Ya. P. Storozhuk et al 3 Dec. 1968 53 p Transl. into ENGLISH from Russian publ.
Avail: CFSTI CSCL 21/5

Basic descriptions and classifications are given of combustion chambers currently used in stationary gas turbine units manufactured in the Soviet Union. It is pointed out that in the Soviet Union, annular combustion chambers are not used in stationary gas turbines. The most commonly used combustion chambers are provided with fuel nozzle swirl cups, telescopic flame tubes, and various cooling modes. An analysis of published experimental results indicates that the combustion process in combustion chambers with a single swirl cup is satisfactory only when the flame tube diameter does not exceed a certain maximum magnitude. When the diameter exceeds 1999-1200 mm, the turbulence dimenishes suddenly, resulting in a flame lag and a reduction in combustion efficiency. For this reason, large combustion chambers are provided with multiple swirl cups. Chambers are usually equipped with either three or five swirl cups. Very intensive combustion of liquid fuel was noted in chambers provided with five swirl cups. Combustion chamber parameters and designations of Soviet stationary gas turbines are presented in tabulated form. Author (TAB)

N70-14410*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
SPACE STORABLE ENGINE CHARACTERIZATION Final Report
A. I. Masters, A. W. Brooke, and T. E. Bailey 24 Nov. 1969 300 p refs
(Contract NAS3-12010)
(NASA-CR-72552; PWA-FR-3169) Avail: CFSTI CSCL 21E

Analyses were conducted for determination of an optimum cycle, turbomachinery arrangement, and design point for a 5000 lb thrust flox/methane pump-fed engine. The expander cycle with a geared drive turbopump was selected at nominally 500-psia chamber pressure, an expansion ratio of 70:1, and a mixture ratio of 5.25. A preliminary engine design including component layouts was completed for the selected configuration. Unique design features include a thermal skin (a laminated channel-type coolant passage construction) thrust chamber and a nozzle contour suitable for addition of a 100:1 nozzle extension. The design provides for uprating to 8000 lb (35.59 kN) thrust and throttling at 10% thrust. Author

N70-14423# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBLEM OF CREATING INTERMEDIATE GAS PREHEAT COMBUSTION CHAMBERS IN A GAS TURBINE UNIT
Yu. M. Pchelkin et al 13 May 1969 11 p Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavendenii, Energ. (Minsk), v. 11, no. 1, 1968 p 110–114
(AD-695892; FTD-MT-24-74-6921) Avail: CFSTI CSCL 21/5

A preliminary research study on the development of an annular combustion chamber with a preheating process is described. The chamber design is shown. The external liner and internal liner circumscribe the chamber volume which contains stabilizer combined with the fuel nozzle. The internal channel of the stabilizer-fuel nozzle unit contains blading apparatus with a 45 degrees flow deflection angle. The fuel flows from annular collector through a series of slots 0.35 mm in diameter. The fuel is injected at a pressure exceeding that of gases by 0.5-1.5 ata. The fuel-air mixing takes place in internal channels of the stabilizer-fuel nozzle. The telescopic liner confines the flame to the combustion zone. Up to 25 percent of the air is bypassed through annular channels and for cooling purposes. Author (TAB)

N70-14466# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF MAKING JET ENGINE NOZZLES FROM TUBULAR STOCK
Yu. P. Sogrishin et al 3 Apr. 1969 5 p Transl. into ENGLISH from Russian Patent no. 201319 (Appl. no. 767553/25-8, 3 Mar. 1962) 1 p
(AD-695353; FTD-HT-23-1391-68) Avail: CFSTI CSCL 21/5

This Author's Certificate introduces a method for making jet engine nozzles from tubular stock. The finished part consists of

a ribbed copper alloy jacket with a refractory steel liner welded to its inner surface. To improve productivity and nozzle quality, the sleeve is formed and welded to fit the jacket which is prestamped by some process such as explosive forming with simultaneous pressing of the ribbed outer surface. Author (TAB)

N70-14488# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN DESIGN PECULIARITIES OF AUTOMOTIVE GAS TURBINES
Yu. I. Frieman et al 22 May 1969 20 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv. Energ. i Transp. (USSR), no. 2, 1968 p 40–47
(AD-694842; FTD-MT-24-521-68) Avail: CFSTI CSCL 21/5

This paper examines design characteristics of automobile gas-turbine engines: the engines almost always operate at considerably below rated power and over a wide rpm range and they are often shifted from mode to mode and therefore must have good pickup. A twin-shaft turbine with heat exchanger is considered, but almost everything discussed applies to any automobile gas-turbine engine. It is shown that the rated pressure increase in the compressor must ensure minimum specific fuel consumption under average operating conditions. Selection of the basic engine parameters on the basis of minimum total cost per unit of transport work is proposed as a general approach to design. Author (TAB)

N70-14549*# Rocketdyne, Canoga Park, Calif.
CORRELATION OF SPRAY DROPSIZE DISTRIBUTION AND INJECTOR VARIABLES Interim Report
R. M. Knight and W. H. Nurick 30 Sep. 1969 93 p refs
(Contract NAS7-726)
(NASA-CR-107411; R-7995) Avail: CFSTI CSCL 21E

A seven-month applied research program was conducted to determine the effects of liquid miscibility and several injector design variables on spray dropsize and size distribution. The method of frozen wax was used throughout the program to provide a quantitative measure of these effects. In the miscibility studies, experiments were conducted with unlike-doublet elements of varying diameter ratio to ascertain the effects of miscibility on droplet size and distribution. In addition, investigations were conducted with unlike-doublet and pentad elements to determine the level of emulsification which occurs when two immiscible liquid jets impinge. In the investigation of injector design variables, single-element injectors of like-doublet, unlike-doublet, and pentad configurations were flowed at low injection velocities (30 to 60 ft/sec) to extend previous dropsize correlations to the low velocity regime. Author

N70-14555# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRUCTURE AND STRENGTH OF AIRCRAFT GAS-TURBINE ENGINES
Z. S. Pallei et al 14 May 1969 413 p refs Transl. into ENGLISH of the book "Konstruktsiya i Prochnost Aviatsionnykh Gazot Urbinnykh Dvigatelei" Moscow, Transport, 1967 p 1–426
(AD-696042; FTD-HT-23-903-68) Avail: CFSTI CSCL 21/5

This book is intended for mechanical engineering students intending to work in civil aviation. The book deals with the principal structural members and systems of aircraft gas-turbine engines and with their advantages and short-comings. Strength and vibration calculation methods are presented along with data on critical rotor speeds. Author (TAB)

N70-14583*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
STUDIES OF MIXING IN DUCTED FANJET ENGINES
Albrecht Hartmann Washington NASA Nov. 1969 87 p refs Transl. into ENGLISH from Forschungsber. (Westphalia), no. 1925, 1968 77 p
(Contract NASw-1692)
(NASA-TT-F-12562) Avail: CFSTI CSCL 21E

The calculation of mixing is described for a mixture assumed to be ideal, and for the optimum partial mixture. The relationships for the optimum mixing process are derived. By means of theoretical considerations, it is shown why advantages are expected from jet mixing for dual-cycle engines, and that the thrust and efficiency with mixing is 10% higher than the corresponding values without mixing. The maximum gain from mixing is presented as a function of the pressure ratio in the first cycle, the intake-gas temperature, the bypass ratio in the first cycle, and the drag caused by an assumed engine pod. Author

N70-14603# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF AN INCREMENTAL METHOD TO ANALYZE THE OPERATION OF TURBINE STAGES IN CHANGING REGIMES
A. M. Topunov et al 30 Jan. 1969 14 p refs Transl. into ENGLISH from Sudostronie (Leningrad), v. 29, no. 12, 1963 p 29–32
(AD-694826; FTD-HT-23-738-68) Avail: CFSTI CSCL 21/5

The authors make use of the difference methods of A. Ye. Cherkez, Applications of the Method of Small Deviations in the Theory of and Calculations for Aviation Turbojet Engines, Oborongiz, 1955, which they apply to the analysis of the working of single- and multi-stage gas turbines in different regimes. The parameters considered in describing the regime are pressure and temperature fore and aft of the turbine stage, consumption of working fluid and rotational speed of the turbine. Universal characteristic curves are presented which show the pressure drops and efficiencies for a two-stage turbine. It is stated that an extension of difference techniques to turbines in supercrutical regimes and in special constructions (such as a birotating turbine) is in progress. Author (TAB)

N70-14881# Air Force Systems Command, Wright-Patterson AFB, Ohio.
TRANSIENTS IN THE NONLINEAR DYNAMIC SYSTEM OF A TWIN-SHAFT GAS-TURBINE POWER PLANT
V. I. Fedorov et al 15 May 1969 13 p refs Transl. into ENGLISH from Teploobmen v Energeticheskikh Ustanovkakh (Kiev) 1967 p 39–48
(AD-693818; FTD-HT-23-58-69) Avail: CFSTI CSCL 6/3

Data presented were obtained by analyzing transfer processes in the nonlinear system of a dual shaft GTU-50-800 with regenerator, multiple stage compressor, intercooler, and combustor. A logarithmic solution to the 14th order differential equation for the nonlinear system was worked out on a BESM-2M computer. As an example, the characteristics of the transfer processes were obtained for power plants with partial load operation. This revealed that a change of many variables is accompanied by small amplitude vibrations. Author (TAB)

N70-14918*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF TEST RESULTS FROM A 90 DEG SECTOR AND A FULL ANNULUS ADVANCED TURBOJET COMBUSTOR
Porter J. Perkins Oct. 1969 17 p refs
(NASA-TM-X-52707) Avail: CFSTI CSCL 21E

Test results of a 90 deg sector combustor and a full annular combustor of the same configuration were compared, using separate component test rigs. The combustor investigated was of the double annulus, short length type using the ram-induction concept. It was designed for turbojet engines operating at supersonic flight speeds up to Mach 3. Measurements in the two rigs of combustor performance including combustion efficiency, pressure loss, exit temperature pattern factor, and exit temperature profile showed good comparisons. Problems of poor circumferential exit-temperature profiles caused by nonuniform air flow in the

diffuser occurred in both rigs. Corrections were developed for the 90 deg sector using a diffuser modification. The same modification applied to the full annulus also corrected the problem. These results proved the value of sector testing in the development of this combustor. Author

N70-15008# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD FOR ANALYZING THE EFFICIENCY OF ENGINE CYCLES IN p–NU COORDINATES
L. A. Khak 30 Apr. 1969 12 p ref Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Mashinostr. (Moscow), no. 8, 1967 p 79–82
(AD-695358; FTD-MT-24-474-68) Avail: CFSTI CSCL 21/7

This article gives the basis of a method of analyzing the efficiency of thermodynamic cycles of engines in the p - v coordinates; examples are given where idealization of the cycles is produced only according to the working substance (ideal gas) and the processes of heat supply and heat removal are arbitrary. Author (TAB)

N70-15098 Florida Univ., Gainesville.
FISSIONING URANIUM PLASMA FOR ROCKET PROPULSION
Henry Foust Atwater (Ph.D. Thesis) 1968 220 p
Avail: Univ. Microfilms: HC $9.90; Microfilm $3.00 Order No. 69-5376

A fissioning uranium plasma for use as a high temperature self-sustaining energy conversion device is studied theoretically. The study is oriented with particular emphasis on the use of the fissioning plasma as a heat source for rocket propulsion systems, although the ideas and methods which are developed can also be applied to a closed cycle heating system which utilizes the fissioning plasma principle. The effects of coupling mechanisms between nucleonic and plasma properties of the fissioning plasma are identified and analyzed for a reference model. The model is based on a central fuel region of fully enriched uranium surrounded by a hydrogen coolant region, contained within a cylindrical graphite chamber. The uranium region serves as a heat source through liberation of radiant energy from fissioning uranium nuclei. The radiant heat transfer from the uranium plasma to the hydrogen coolant plasma is accomplished by seeding the coolant. Dissert. Abstr.

N70-15132*# Rocketdyne, Canoga Park, Calif. Processing Metallurgy Unit.
DESIGN AND APPLICATION OF SELF-COOLED ROCKET NOZZLES Final Report, 5 Jan. 1968 – 31 Oct. 1968
Peter Schwarzkopf Oct. 1969 68 p refs
(Contract NAS1-7741)
(NASA-CR-66861; R-8057) Avail: CFSTI CSCL 21H

The results of an analytical study to design optimum zinc-infiltrated self cooled nozzle inserts for a hybrid propellant rocket motor are presented. A computer programmed heat transfer analysis was used to study the duration of thermal protection of various self cooled composite designs of different matrix porosities for the anticipated conditions of 6855 F maximum flame temperature and maximum combined film and radiative heat transfer coefficient of 2300 Btu sq ft-hr-F. A bilayer composite containing 50 percent porosity in a volume beneath a 20 percent porous throat surface layer was shown to give maximum anticipated service lifetime. A 30 to 40 percent improvement over a tungsten heat sink nozzle was predicted with a self cooled insert. Author

N70-15171# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIQUID FUEL ROCKET ENGINES: DESIGN FUNDAMENTALS, VOLUME 1
M. V. Dobrovolskiy 27 Jun. 1969 244 p refs Transl. into ENGLISH of the book "Zhidkostnyye Raketnyye Dvigatelli. Osnovy Proyektirovaniya" Moscow, Mashinostr., 1968 p 1–396
(AD-695929; FTD-MT-24-135-69-Vol-1) Avail: CFSTI CSCL 21/8.1

The book presents design fundamentals of liquid fuel rocket engines (ZhRD). It considers questions of design of the engine chamber and the propulsion system on the whole. Basic statements of the theory, methods of calculation and description of subassemblies and units of devices with liquid fuel rocket engine are given. Processes of expansion of gases in nozzles, carburetion and heat exchange are expounded, as well methods of profiling nozzles, calculation of injectors, determination of forms and volumes of combustion chambers. An analysis of work of installations with open and closed circuits is given. Supply systems with turbopump assemblies and pressure feed systems with gas, powder, and liquid pressure generators are considered. Much attention is allotted to work of installations with closed circuits and methods of power coordination of such circuits. Examples of propulsion systems were given, in particular, a description of the propulsion system of the rocket Vostok. Author (TAB)

N70-15172# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIQUID FUEL ROCKET ENGINES: DESIGN FUNDAMENTALS, VOLUME 2
M. V. Dobrovolskiy 27 Jun. 1969 218 p refs Transl. into ENGLISH of the book "Zhidkostnyye Raketnyye Dvigatelli. Osnovy Proyektirovaniya" Moscow, Mashinostr. 1968 p 1–396
(AD-695925; FTD-MT-24-135-69-Vol-2) CSCL 21/8.1

The report gives actual data on structures, fuels, and materials and their characteristics on the basis of foreign and domestic publications. Examples of design are purely methodical and do not pertain to any defined type of engine. The book is a textbook for students of higher educational institutions and can also be useful to engineers and graduate students specializing in rocket technology. Author (TAB)

N70-15396*# Nielson Engineering and Research, Inc., Palo Alto, Calif.
THEORETICAL STUDY OF DUCTED FAN PERFORMANCE
Michael R. Mendenhall and Selden B. Spangler Washington NASA Jan. 1970 52 p refs
(Contract NAS2-4953)
(NASA-CR-1494; NEAR-TR-15) Avail: CFSTI CSCL 01A

Analysis and programming work were conducted to provide an improbed capability in an existing computer program developed previously for predicting the performance of a ducted fan in a uniform axial flow. The capabilities were added for modeling the centerbody, providing nonlinear blade lift characteristics, calculating performance at very low advance ratios, computing duct surface pressure distributions, and computing performance at angle of attack. The computer program considers a prescribed ducted fan operating at a given advance ratio in a uniform flow at angle of attack. The ducted fan is described by the duct chord to diameter ratio, duct camber and thickness distribution, centerbody shape, axial location of the fan, number of fan blades, and the radial variation of fan blade chord, pitch angle and thickness to chord ratio. The computer program solves for the blade loading, fan inflow profiles, forces and moments on the ducted fan, and chordwise pressure distributions on the duct at specified azimuth angles. Author

N70-15486*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SEMIANNUAL REVIEW OF RESEARCH AND ADVANCED DEVELOPMENT, 1 JANUARY 30 JUNE 1969, VOLUME 2 (OART)
15 Aug. 1969 703 p refs
(Contract NAS7-100)
(NASA-CR-107549; JPL-701-32-Vol-2) Avail: CFSTI CSCL 20H

Supporting research and advance technology in progress are reviewed. Space power and electric propulsion systems are

discussed in terms of nuclear, solar, and chemical power generation. Vehicle aerothermodynamics, vehicle structures, space environmental factors, and vehicle design criteria are topics included under space vehicle systems. Electronic systems discussed are: guidance and control, communications, tracking, data handling and acquisition, and techniques and components. Liquid and solid rocket technologies are assessed along with chemical rocket experimental engineering. Fluid and electro physics research are also covered. Applications of mathematics and polymer research are other topics reviewed. J.M.C.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-14569*# Denver Research Inst., Colo. Dept. of Physics.
LONG RANGE SOLAR FLARE PREDICTION Final Report, Jun. 1968 - Aug. 1969
J. B. Blizard Oct. 1969 177 p refs
(Contract NAS8-21436)
(NASA-CR-61316) Avail: CFSTI CSCL 04A

Statistical studies of solar cycles show a high correlation between solar perturbations and proton events. It is hypothesized that the motion of the sun and planets about the center of mass of the solar system could trigger solar disturbances in unstable zones in the solar subphotosphere at active longitudes. The results of this study indicate that many of the major recorded proton events occurred near major planet conjunctions. Author

N70-14611# Utah Univ., Salt Lake City. Upper Air Research Labs.
CHARACTERISTICS OF AURORAL PARTICLE FLUX
Kenneth E. Phillips Apr. 1969 230 p refs
(Contract F19628-67-C-0275; Grant NSF GA-355)
(AD-695520; UU69-4) Avail: CFSTI CSCL 4/1

An auroral experiment, utilizing a rocket payload (Aerobee 3.615), provided direct in situ measurements of the primary auroral flux which was precipitated during the breakup phase of a medium intensity IBC II auroral event above Churchill Research Range, Manitoba, Canada on 14 December 1966. The rocket payload included instrumentation for determining both the number densities of the proton and electron flux and the total energy carried by the particles. The bright auroral displays, manifest in the all-sky camera photographs, occurred usually some distance from the rocket; the region surrounding the rocket being usually characterized by only dim-diffuse auroral displays. However, when the rocket was at an altitude of 130 km on the descent portion of the flight, a bright auroral arc quickly developed in the immediate vicinity of the rocket. The rockets penetration of this bright arc was marked by rapid increases in the particle flux measurements; the energy flux and number densities increased by a factor of ten. Author (TAB)

N70-14693# California Inst. of Tech. Pasadena. Astronomy Div.
[HIGH RESOLUTION OBSERVATIONS OF SOLAR PHENOMENA] 1 AUG. 1966 - 31 JUL. 1969
Harold Zirin Sep. 1969 8 p refs
(Contract N00014-67-C-0140)
(AD-694538) Avail: CFSTI CSCL 3/2

The purpose of the contract was to carry out high resolution observations of solar phenomena with the goal of better understanding of solar flares and solar activities. In the three years activity we have obtained some of the best records of solar activity ever made, and have reached a new level of understanding of solar flares and concurrent phenomena. A rich storehouse of films of the peak of solar activity has been built up. Author (TAB)

N70-15058*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville Ala.
ELECTRON BREMSSTRAHLUNG SHIELDING AT SYNCHRONOUS ALTITUDE BY ELECTRON TRAPPING IN DIELECTRICS
D. L. Hollis 22 Aug. 1969 22 p refs
(NASA-TM-X-53954) Avail: CFSTI CSCL 04A

Synchronous altitude electron bremsstrahlung shielding by electron trapping in a layer of dielectric material on the outer surface of a spacecraft is studied. Traps in the insulating material retain bombarding electrons and produce an internal spacecharge field of large magnitude. The electric field repels or slows additional electrons. This acts to reduce bremsstrahlung production, lower the photon energy, and enhance photon absorption. The breakdown phenomenon causes the shielding effect of the trapped electrons to be cyclic. Qualitative calculations indicate that a 40 percent decrease in mass results when a thin layer of polyethylene instead of lead is used in reducing bremsstrahlung in an aluminum wall to the same level. Suggestions are given to modify existing Monte Carlo codes for this particular application. Author

N70-15141 California Univ., Berkeley.
LOW FREQUENCY ELECTROSTATIC INSTABILITIES IN THE MAGNETOSPHERE AND THEIR CONSEQUENCES
Chuan-Sheng Liu (Ph.D. Thesis) 1968 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-3648

The stability of the Van Allen belt in the outer trapping zone against electrostatic low-frequency perturbations is studied. Inside the plasmapause, the energetic belt is found to be stable. Outside the plasmapause, the ring current belt is bound to be unstable when the density gradient at the outer edge exceeds a certain critical value. A component of the electric field along the magnetic field line is associated with the instability. When the ring current belt is stable by itself, it supports a wave which can resonantly interact with the drift motion of the energetic particles. The condition for overstability is derived. The possible relevance of the instabilities to auroral phenomena is discussed. Dissert. Abstr.

N70-15166*# Maryland Univ., College Park. Space Physics Group.
AN EXPERIMENTAL INVESTIGATION OF FLUCTUATIONS AND CORRELATIONS IN ELECTROMAGNETIC AND NUCLEAR SHOWERS DEVELOPING IN LEAD
Julius J. Brecht (Ph.D. Thesis) 1969 127 p refs
(Grants NGR-21-002-066; NGL-21-002-008)
(NASA-CR-107571; TR-955) Avail: CFSTI CSCL 04A

Electron showers at 105, 150, 300, 600, 1000, and 1200 MeV were studied using a Geiger tube hodoscope developed for balloon altitude observations of cosmic ray particles. The electron shower curves calculated from the experimental data are different from those obtained by other experimenters with various other detectors. Events obtained by exposing the detector to sea level cosmic ray mesons and to artificially accelerated protons and pions were treated in a manner identical to that used to analyze the electron data in hopes of detecting differences between electron showers and nuclear interacting events. Although some differences were found, the general characteristics of the nuclear interacting events were very similar to the electron showers. Author

N70-15187*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
INVESTIGATIONS OF THE TRAPPED MAGNETIC FIELD
Ronald R. Winters [1969] 50 p refs
(Contract NAS8-21451; Proj. DSR-71179)
(NASA-CR-107591; RE-63) Avail: CFSTI CSCL 04A

Analytic expressions for the spatial and time behavior of trapped magnetic fields in a cylindrical conductor are found for two sets of boundary conditions. Estimates are obtained for the diffusion time in terms of the geometry of the conductor. The diffusion time constant for the magnetic field trapped in a rotating aluminum disc is measured and compared with estimates obtained from solutions of Maxwell's equations. The measured diffusion times are in fair agreement with the mathematical model. Estimates of a measure of the spatial variations in the trapped magnetic field are also obtained. The temperature dependence of the diffusion time for the magnetic field trapped in a moving conductor is consistent with the temperature dependence of the conductivity of the conductor. The result is relevant to assumptions in the Babcock model of sun spots. An experiment which studies the amplification of an azimuthal component of an initially axisymmetric magnetic field trapped in a moving conductor is described. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-14185*# Bellcomm, Inc., Washington, D.C.
REPRESENTATION OF OSCULATING ORBITAL ELEMENTS BY ANALYTIC FUNCTIONS
M. Lybanon and R. M. Scott 30 Sep. 1969 74 p refs *Its* Case 310
(Contract NASw-417)
(NASA-CR-107378; B69-09103) Avail: CFSTI CSCL 22C

An alternative to the usual method of orbit determination is the approach of fitting functions to the osculating orbital elements. An investigation was conducted to find functional forms suitable to represent a variety of lunar orbits. Three Apollo type orbits were artificially generated and used as data. Both classical and Hubbard elements were used. The functional forms which were found were evaluated and compared with the original data. Plots of the UVW component residuals are presented. Two revolution fits had much better propagation characteristics than one revolution fits. It is felt that Hubbard elements are more useful than classical elements. Author

N70-14235*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-59, VOLUME 1 FOR THE PERIOD 1 JULY TO 31 AUGUST 1969. FLIGHT PROJECTS
30 Sep. 1969 50 p refs
(Contract NAS7-100)
(NASA-CR-107315; JPL-SPS-37-59-Vol-1) Copyright. Avail: CFSTI CSCL 22A

Mariner Mars 1969 and 1971 project activities are reviewed along with those of the Viking Project. Status, analysis of systems, engineering mechanics, and guidance and control systems for Mariner flights are discussed. Development of a boron-epoxy compression strut, mechanical configuration and load analysis, and propulsion and pyrotechnics for the orbiter system of Viking flights are also discussed. Test results and recommendations are included. J.M.C.

N70-14257*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELD FLUCTUATIONS IN THE MAGNETOSHEATH OBSERVED BY PIONEER 7 AND 8
F. Mariani (CNR, Rome), B. Bavassano (Rome Univ.) and N. F.Ness Dec. 1969 35 p refs
(NASA-TM-X-63762; X-616-69-541) Avail: CFSTI CSCL 04A

Fluctuations of the magnetic field at frequencies less than 0.05 Hz have been studied in the magnetosheath from data obtained by Pioneers 7 and 8. During the first two weeks of their flight, the probes were in similar trajectories along an approximately radial directions from the earth. Magnetic fluctuations inside the magnetosheath are essentially transverse to the field vector and the most excited field component is perpendicular to the ecliptic plane. The entire spectrum is excited. The magnetic energy associated with the fluctuations is found to exponentially decay with increasing distance transverse to the sun earth line. These results suggest that the fluctuations represent an enhanced microstructure produced by the amplification of small convected irregularities occurring at the bow shock. Author

N70-14287*# Techtran Corp., Glen Burnie, Md.
CALCULATION OF THE MOTION OF A LOW-THRUST SPACECRAFT
V. N. Lebedev Washington NASA Nov. 1969 111 p refs Transl. into ENGLISH from Akad. Nauk USSR, 1968 p 3–104
(Contract NASw-1695)
(NASA-TT-F-586) Avail: CFSTI CSCL 22C

The derivation and analysis of simple methods of control which make it possible to execute certain maneuvers are considered. The basic requirement imposed upon these control methods is simplicity of analysis and execution. Methods of control which maintain the osculating elements, or their more rapidly changing values, constant are examined. The methods of control described, and combinations of them, can be used for the execution of a variety of maneuvers. Author

N70-14300# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.
DISTRIBUTION OF SLOPES ON A CRATERED PLANETARY SURFACE
Allan H. Marcus Jan. 1969 42 p refs
(Contract Nonr-4010(09))
(AD-695448; TR-110) Avail: CFSTI CSCL 8/7

The distribution of slopes over any finite span on a surface excavated by primary impact craters is derived from a representation of the surface as a moving average of impact events. The cumulants are always positive, and are large for typical mare crater densities. In some cases the distribution can be approximated by a rapidly convergent Gram-Charlier Type A series. The slope distribution has much heavier tails, than a Gaussian distribution with the same variance. Under some conditions, the slopes have approximately a symmetric stable distribution law with characteristic exponent one smaller than the crater diameter population index. Observations of slopes in Mare Cognitum are in good agreement with theory. Author (TAB)

N70-14343*# National Academy of Sciences-National Research Council, Washington, D.C. Space Sciences Board.
THE OUTER SOLAR SYSTEM: A PROGRAM FOR EXPLORATION
Jun. 1969 90 p Sponsored by NASA
(NASA-CR-107324) Avail: CFSTI CSCL 03A

A long-term plan is recommended for the exploration of the outer parts of the solar system, including a Jupiter deep-entry probe and flyby, Jupiter croiter mission, Earth-Jupiter-Saturn-Pluto missions, Earth-Jupiter-Uranus-Neptune missions, and Earth-Jupiter-Uranus entry-probe missions. Continuation of the Pioneer capability for outer solar system studies and the development of a new spacecraft of flexible capability and increased payload capacity are suggested. Requests are made for a hybrid spinning spacecraft, design studies leading to a data system that can handle both cruise mode and encounter operation, and design of a spacecraft that can survive and remain magnetically clean after passing through the Jovian environment. Design studies are requested for mass spectrometers for deep-entry probes and for several types

of imaging systems. Recommendations are made for development of advanced methods of propulsion useful for exploration of the solar system. Author

N70-14620# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
THE TROJAN MANIFOLD: SURVEY AND CONJECTURES
Andre Deprit and Jacques Henrard Sep. 1969 41 p refs /ts Mathematical Note No. 622
(AD-695555; DI-82-0911) Avail: CFSTI CSCL 3/3

Recent results concerning the families of periodic orbits emanating from the triangular equilibrium L sub 4 are interpreted in an attempt to establish the evolution of these manifolds as the mass ratio varies from Rouths critical value down to its value in the system Sun-Jupiter. Author (TAB)

N70-14871*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOPOTENTIAL COEFFICIENT RECOVERY FROM VERY LONG ARCS OF RESONANT ORBITS
Carl A. Wagner and Elise R. Fisher Nov. 1969 28 p refs
(NASA-TM-X-63774; X-552-69-498) Avail: CFSTI CSCL 22C

Maneuver free orbital arcs of 12 and 24 hour satellites are extremely sensitive to low degree and order terms of the geopotential. To utilize these long orbital arcs for geodesy, orbits and variational equations are integrated numerically in a mean element coordinate system. All gravitational perturbations and drag and radiation pressure effects are included. Tests with published gravity models on these long term arcs indicate that considerable improvement in low order coefficients beyond the second degree is possible and desirable. New results from combined 12 to 24 hour satellite data have also been obtained. A resonance corrected SAO 1969 field is presented which should have the most accurate set of low order coefficients calculated to date. Author

N70-14968*# Hawaii Univ., Honolulu. Inst. of Geophysics.
NATIONAL GEODETIC SATELLITE PROGRAM (NGSP) STATION SOLUTIONS
A. Mancini, L. Gambino, J. Reece (Geonautics, Inc.), and J. Richardson (Geonautics, Inc.) Oct. 1969 86 p refs
(Contract NSR-12-001-055)
(NASA-CR-107477) Avail: CFSTI CSCL 22C

Presented are the results and analysis derived from a short-arc, orbital solution of the twelve stations, Phase I, PAGEOS network and the results of a geometric reduction combining the BC-4 and Baker–Nunn networks in a simultaneous adjustment. Comparisons of the derived station solutions from the short-arc reductions are made with some of the published NWL doppler derived station coordinates and with some of the Ohio State University solutions. It is believed that a station accuracy of plus or minus 15 m. has been achieved. Only preliminary comparisons could be made with the geometric solution since the problem of equation instability prevented an adequate solution. Tables showing the Root Mean Square (RMS) of the orbital solution indicates that there is no statistical contradiction with the results obtained from the orthogonal polynomial fitting process, which was done at an earlier date for the initial data screening prior to the geodetic station solutions. Other tables are presented which give the final position and velocity vectors for all orbits used in the 12 station, simultaneous, BC-4 orbital solution. A representative sample of the orbital correlation matrix is also presented in the report. Author

N70-14983*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROCKET SPECTROSCOPY OF ZETA PUPPIS
Andrew M. Smith Nov. 1969 36 p refs
(NASA-TM-X-63781; X-613-69-494) Avail: CFSTI CSCL 03B

A spectrum of Zeta Pup extending from 920 A to 1360 A with approximately 0.8 A resolution has been recorded at rocket altitudes. Tentative identification of 102 multiplets of both stellar and interstellar origin was made, from which it is concluded that all lines included in existing model atmospheres have been detected with the exception of those masked by telluric N2 or strong P Cygni type profiles. Additional weak absorption lines indicate a wide range of ionization and excitation entirely consistent with observations in the visible spectral region of similar type stars; they also appear to affect sensibly the energy distribution within the spectrum. The results suggest a positive velocity gradient in the observed portion of the circumstellar envelope, and that the escaping ions are loosely bound together with essentially no difference in their average acceleration away from the star. Author

N70-15038*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTIMAL TRANSFER TRAJECTORIES FROM EARTH PARKING ORBIT TO VARIOUS TERMINAL CONIC CONSTRAINTS AND MODIFICATIONS TO THE ROBOT COMPUTER PROGRAM
Rodney Bradford 1 Oct. 1969 135 p refs
(NASA-TM-X-53873) Avail: CFSTI CSCL 22C

Reference optimal (minimum fuel consumption) transfer trajectories were computed by the minimum Hamiltonian-steepest ascent method for departure from a circular parking orbit about the earth to various terminal conic constraints. Terminal conditions were a circular orbit at synchronous altitude, 35 862 km, an elliptical orbit with apogee at synchronous altitude (in-and-out-of-parking-orbit-plane), and an injection burn into a typical 1973 Mars mission hyperbolic orbit. The vehicles used to perform these transfers were the S-IVB stage and the Command Service Module. Also included is a typical ascent trajectory profile utilizing a two stage Saturn IB launch vehicle. Detailed orbital and trajectory profile parameters are presented in tabular form. Modifications made to the ROBOT-Apollo and AAP Preliminary Mission Profile Optimization computer program are also presented. Author

N70-15054# Army Foreign Science and Technology Center, Washington, D.C.
RESULTS OF MEASUREMENTS OF SOME RADIO SOURCES AT A WAVE LENGTH OF 5.2 cm REPORTED AT THE CONFERENCE ON SOURCES OF COSMIC RADIO EMISSION, GORKII, 1966
L. I. Matveenko et al 14 Oct. 1969 17 p refs Transl. into ENGLISH from Izv. Vysah. Ucheb. Zaved., Radiofiz. (Gor'kiy), v. 11, no. 5, 1968 p 680–688
(AD-695992; FSTC-HT-23-623-69) Avail: CFSTI CSCL 03/2

Methods and results of measuring radio emission of certain quasars and Seyserts galaxy NGC 1275 are considered. Their flux densities at the wave length 5.2 cm are given. A change in the flux density of radio emission is noted in several sources. Author (TAB)

N70-15088*# Arizona Univ., Tucson.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME 9, NO. 2
G. P. Kuiper, ed., L. A. Bijl, and D. P. Cruikshank 1969 80 p refs /ts Commun. Nos. 163–165
(Grant NGL-03-002-091)
(NASA-CR-107444) Avail: CFSTI CSCL 04A

Solar spectrum records obtained on high altitude flights of the NASA CV-990 and covering the interval 17731 to 30902 A are presented. The 1.8 micron water-vapor band spectra were used to distinguish water-vapor absorptions from solar absorptions. Courtoy's carbon dioxide absorption spectrum is reproduced. Laboratory spectra of 2.20, 2.32, and 2.37 micron bands of methane and of water-vapor band wings at 2.7 microns are included along with the 8-6 and 9-7 solar carbon monoxide bands. The 2.7 micron water band spectra and Courtoy's spectrum of 2.7 micron carbon dixide bands are given. J.A.M.

N70-15077 Royal Observatory, Edinburgh (Scotland).
ABUNDANCE DETERMINATIONS IN LATE-TYPE STARS FROM SCHMIDT CAMERA OBJECTIVE PRISM SPECTRA
W. B. Samson 24 Mar. 1969 19 p refs *Its* Publ., Vol. 6, No. 10
Copyright. Avail: HMSO: 6s 6d; BIS $1.30

Sixty two stars of types F and G were observed using a 40/80 cm Schmidt camera with an objective prism giving a dispersion of 400 A/mm at the wavelength of H gamma. Parameters corresponding to Fe abundance, CH-band strength, and CN-band strength were measured, along with a parameter corresponding to the effective temperature, for each star, with rms errors in the parameters of about 8% for three observations. Using only the measured values of the parameters, and no other observational data, corrections were applied to remove temperature dependence from the Fe, CN and CH parameters and to remove chemical composition from the temperature parameter. The CH and CN parameters are found to be sensitive to luminosity, the CN parameter increasing with luminosity at about six times the rate of the CH parameter. Author

N70-15085*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PERIODIC ORBITS IN THE ELLIPTIC RESTRICTED THREE-BODY PROBLEM Technical Report, 1 Jul. 1967 – 30 Jun. 1968
R. A. Broucke 15 Jul. 1969 131 p refs
(Contract NAS7-100)
(NASA-CR-107555; JPL-TR-32-1360) Avail: CFSTI CSCL 22C

Results of a detailed study of the two-dimensional, elliptic restricted three-body problem are presented. The equations of motion and the variational equations have been solved with recurrent power series. Several computer programs have been prepared to use the recurrent power series for the generation of families of periodic orbits. Some of these programs have been regularized with the well-known Birkhoff regularization. A total of 15 families of periodic orbits (1127 orbits) are described. The linear stability of several of these orbits has been computed; that of periodic orbits has been studied theoretically for the elliptic problem and for any nonintegrable, nonconservative, dynamical system with two degrees of freedom, and it has been found that seven types of stability or instability exist. Periodic orbits have been obtained for both the earth-moon mass ratio and the Stromgren mass ratio (equal masses). The whole range of eccentricities e from 0 to 1 (including 1) has also been studied, and it is shown that some periodic orbits exist for all of the eccentricities. A family of periodic collision orbits is also described. Author

N70-15089*# Lockheed Missiles and Space Co., Huntsville, Ala.
TRAJECTORIES FOR THE 1976-1980 GRAND TOUR OPPORTUNITIES. VOLUME 1: GRAPHIC AND SUMMARY TRAJECTORY DATA
H. W. Gatzke and L. M. Billmeier Jul. 1969 133 p refs
(Contract NAS8-20082)
(NASA-CR-61303) Avail: CFSTI CSCL 22C

A close encounter with a planet on a flyby (swingby) trajectory has the effect of a propulsive maneuver on the heliocentric trajectory, thereby resulting in an increase of energy, decrease of energy or a plane change and energy change. Graphic and summary tabular data are presented for swingby missions that collectively encounter all five outer planets. Three mission types: (1) Jupiter-Saturn-Uranus-Neptune, (2) Jupiter-Uranus-Neptune, and (3) Jupiter-Saturn-Pluto are considered. Data for powered maneuvers in the vicinity of Jupiter and Saturn that change the pericenter radius are presented. The earth launch opportunities are for the time period 1976-1980. Author

N70-15094 Cincinnati Univ., Ohio.
AN APPLICATION OF HANSEN'S METHOD OF GENERAL PERTURBATIONS TO A MINOR PLANET
Paul Kenneth Seidelmann (Ph.D. Thesis) 1968 79 p
Avail: Univ. Microfilms: HC $4.20; Microfilm $3.00 Order No. 69-6352

Hansen's classical method of general perturbations was revised from its basis on a Taylor series expansion to an iterative method, which can start with the best theory known, or with only the mean, or osculating, elements of the planet. The method and the necessary sub-routines to handle the Fourier series were programmed for a digital computer. A general theory, equivalent to a third order theory by Hansen's classical method, was generated for a fictitious minor planet by the new method and the theory was compared to a numerical integration. The iterative method of determining general planetary theories provides a potentially powerful tool to celestial mechanics, but commensurabilities present a real problem and the most significant drawback to the method. Thus, the method must be used only with careful planning, preparation, and evaluation. Dissert. Abstr.

N70-15112*# National Aeronautics and Space Administration, Washington, D.C.
PLANETARY PROGRAM REVIEW, JULY 1969
11 Jul. 1969 75 p
(NASA-TM-X-62569) Avail: CFSTI CSCL 03A

A baseline review is presented of the objectives, accomplishments, plans, and opportunities associated with the Planetary Program of NASA. The program is concerned with the genesis, distribution and composition of planets and their satellites, the comets and asteroids, and other solid materials in the solar system. It includes the search for extraterrestrial life, embraces such fields as geology, geography, petrography, mineralogy, seismology, vulcanology, astronomy, and aeronomy, and extends their scope of interest beyond the earth to include all the condensed material of the solar system. It also includes examination of the interplanetary environment. Earth-based and space flight programs, including planetary flyby, orbiter, and landing missions, both completed and proposed, are discussed. R.B.

N70-15147*# Techtran Corp., Glen Burnie, Md.
WAYS OF MEASURING THE EARTH-MOON DISTANCE [LES APPLICATIONS DES MESURES DE DISTANCE TERRE-LUNE]
A. Orszag Washington NASA Dec. 1969 10 p Transl. into ENGLISH from Polytech. School report
(Contract NASw-1695)
(NASA-TT-F-12729) Avail: CFSTI CSCL 03B

A discussion is presented of error sources in measurement of the Earth – Moon distance by laser reflection. Sources discussed include atmospheric distortion and the large size of the lunar surface illuminated. Applications of distance measurements may yield improvements in our knowledge of the orbit and movements of the moon, terrestrial geodetics, dynamics of Earth movement and celestial mechanics. Author

N70-15206*# General Electric Co., Philadelphia, Pa. Re-Entry and Environmental Systems Div.
MULTISPECTRAL IMAGING OF MARS FROM A LANDER
V. Klemas and E. L. G. Odell 15 Jul. 1969 170 p refs
(Contract NAS1-8770)
(NASA-CR-66827) Avail: CFSTI CSCL 03B

The primary purpose of this study was to develop a technique for selecting color bands for an imaging system; secondly to investigate the advantages to be gained from using certain solid state detectors; and thirdly to determine if it is feasible by means of data compression, adaptive control, and optimizing the number of grey levels in each color band, to keep the total number of data bits down to a fraction above that required for a black and white panorama from the lander, which has a very limited telemetry rate. A description and results are presented of the analytical approach

which was used to multiply the spectral reflectivity of the selected constituents by the illumination, atmospheric transmission, filter transmission and detector spectral response so as to obtain response and modulation functions for all constituents and each detector considered. By locating optical bandpass filters at the points where the modulation function is largest, optimum discrimination between the constituents can be obtained. The number of equivalent grey levels in each band to accomplish the discrimination is derived. Onboard signature determination, simple data compression schemes and a limited degree of adaptive control are considered. Author

N70-15397*# Astro Research Corp., Santa Barbara, Calif.
RADIO ASTRONOMICAL STUDIES WITH 1500-METER DIAMETER LOW-FREQUENCY TELESCOPE
M. R. Kundu Washington NASA Jan. 1970 53 p refs
(Contract NAS5-11596)
(NASA-CR-1506; ARC-LTN-2) Avail: CFSTI CSCL 03B

A technology development program to create the technical knowledge to support the design of an orbiting low frequency radio telescope (LOFT) is presented. The major concepts of LOFT are: (1) The configuration consists of a paraboloidal reflector, with a 1500-meter aperture, composed of a tenuous network of conducting ribbons, and in an orbit of 6000 km altitude. (2) The configuration is launched in a tightly packaged state. (3) Deployment and centrifugal stiffening are achieved by spinning about the axis. (4) Pointing of the radio telescope is achieved by circulating currents around the net and interacting with the geomagnetic field. (5) The collecting area is on the order of 1 million square meters. Some radio sources are discussed in detail and the usefulness of the LOFT instrument assessed. F.O.S.

N70-15445# Johns Hopkins Univ., Baltimore, Md. Dept. of Statistics.
COMPOUND POISSON VECTOR FIELDS APPLICATIONS IN ASTRONOMY Technical Report
Allan H. Marcus Jun. 1969 22 p refs Revised
(Contract Nonr-4010(09))
(AD-695445; TR-103-Rev) Avail: CFSTI CSCL 3/2

The characteristic function of the joint distribution of a random vector field at two points in space is derived from a representation of the field as the moving average of a homogeneous Poisson point process in an n-dimensional space. This model is used to derive a stable distribution law for the distribution of elevations on a cratered planetary surface; the spectral density function of elevations and the probability density of slopes on a cratered surface are also shown to be approximately inverse-power laws. (For further explanation, see AD-695 450.) In the second application, the logitudinal and transverse covariance functions of a random stellar force field are derived; they are linear functions of distance at distances less than a stellar diameter, and inverse cubic functions of distance at distances greater than a stellar diameter. (For further explanation, see AD-695 453.) Author (TAB)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-14144*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DISTRIBUTION OF NEUTRAL PROPELLANT FROM ELECTRIC THRUSTERS ONTO SPACECRAFT COMPONENTS
Thaine W. Reynolds and Edward A. Richley Washington Dec. 1969 34 p refs
(NASA-TN-D-5576) Avail: CFSTI CSCL 22B

Calculations based on proposed models of two Jupiter flyby probes indicated high enough neutral mercury fluxes on solar panels that condensation could occur halfway through the mission thrusting period. Return fluxes to spacecraft surfaces, while lower, may also encounter condensing conditions because of the possible lower temperature of such surfaces. A simple procedure is presented for estimating possible neutral propellant flux onto surfaces downstream of an electric thruster, or, through reflection or desorption, onto spacecraft surfaces upstream of the thruster exhaust plane. Author

N70-14188# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMAL PURSUIT IN THE HORIZONTAL PLANE
V. I. Polkvnikov 8 Apr. 1969 18 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Kazan), No. 89, 1965 p 138-152
(AD-695214; FTD-HT-23-1273-68) Avail: CFSTI CSCL 16/4

The problem of the optimal in high-speed pursuit of a target moving uniformly and rectilinearly in a horizontal plane is investigated. The control functions are the engine thrust and the deflection angle of the rudders. All the parameters determining the initial relative position and velocity of pursuer and target are given. Natural physical limitations were superimposed on the control functions; in the process of solution it was assumed, however, that boundary values are not reached. Author (TAB)

N70-14368*# National Aeronautics and Space Administration. Manned Spacecraft Center, Cape Canaveral, Fla.
ANALYSIS OF APOLLO 8 PHOTOGRAPHY AND VISUAL OBSERVATIONS
Washington 1969 403 p refs
(NASA-SP-201) Avail: SOD $4.25; CFSTI CSCL 22B

The photographic and visual observations of the lunar topography from the Apollo 8 spacecraft are documented. These observations as well as earth-based astronomical and spacecraft tracking observations are analyzed. Apollo 8 photographic equipment and recording and processing techniques are also described. J.A.M.

N70-14370# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ON THE MOTION AND STABILITY OF A DUAL-SPIN SATELLITE WITH NUTATION DAMPING
Peter M. Bainum, Peter G. Fuechsel, and Donald L. Mackison Jun. 1969 46 p refs
(Contract NOw-62-0604)
(AD-696062; APL-TG-1072) Avail: CFSTI CSCL 22/2

The damping and stability characteristics of a dual-spin satellite system are analyzed. The system consists of: a slowly rotating main part; a high-speed rotor whose spin axis is parallel to the nominal main body spin axis; and one or two pendulous type nutation dampers, pivoted about a torsion wire support and constrained to move in a plane that is perpendicular to the nominal spin axis. After development and linearization of the equations of motion, the necessary and sufficient Routh-Hurwitz stability criteria are obtained. The damping system design is optimized by repeated examination of the roots of the system characteristic equation. Numerical studies using the nonlinear equations were conducted to evaluate the spin axis pointing error, attributed to the dynamic mass unbalance of the main body in a torque-free environment. Author (TAB)

N70-14402*# University of Southern Calif., Los Angeles. Lab. for Atomic and Molecular Physics.
A ROCKET EXPERIMENT TO MEASURE THE EXTREME ULTRAVIOLET DAYGLOW Final Report

Darrell L. Judge [1969] 27 p refs
(Grant NSR-05-018-067)
(NASA-CR-107409) Avail: CFSTI CSCL 16D

The details of the flight instrument are discussed along with the flight data analysis. The results are found to agree surprisingly well with radiative transfer theory. In addition, the shape of the altitude dependence of the dayglow agrees very well with that obtained on the same flight using a completely different method of detection. The absolute intensity, however, is a factor of two greater than the present value. Author

N70-14547*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RAE ANTENNA-DAMPER PACKAGE DEPLOYMENT INTERACTION
Joseph V. Fedor and Bowden W. Ward, Jr. Jul. 1969 24 p refs Submitted for publication
(NASA-TM-X-63764; X-723-69-251) Avail: CFSTI CSCL 22B

The deflections of RAE spacecraft antennas caused by a transient disturbance associated with the deployment of the damper package are obtained. The linear beam dynamical equation including terms for the spacecraft hub movement and the transient disturbance is formulated and a solution obtained by the use of a series expansion utilizing a cantilever modal approach. The results show that a maximum antenna tip deflection in the order of 0.3 feet would be expected to occur for a 450 foot length 8 minutes after deployment of the damper package. Also, spacecraft dynamic simulations indicated that the libration damper would not eliminate this type of antenna motion. Although the calculated boom tip deflections were small, an alternate sequence of RAE deployment was used because of the desire not to disturb the long flexible antennas unnecessarily. Author

N70-14883*# Houston Univ., Tex. Faculty Systems Engineering Inst.
LLV LUNAR LOGISTIC VEHICLE Final Report
C. J. Huang, J. L. Youngblood, S. L. Dickerson, and A. N. Paul Sep. 1969 32 p ref (Contract NSR-44-005-059)
(NASA-CR-107445) Avail: CFSTI CSCL 22B

A systems design summer training institute for engineering faculty is evaluated. Program planning, management, and the selection of participants are discussed. The multidisciplinary engineering problem of designing a lunar logistics vehicle was used as a training project. The close working arrangement with the Manned Spacecraft Center was helpful in producing a useful spacecraft design. Results of an evaluation of the program by the participants are appended. J.M.C.

N70-14925# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
OPTIMUM FEEDBACK CONTROL OF A SYNODIC SATELLITE
Walter D. Seward (M.S. Thesis) Jun. 1969 102 p refs
(AD-695043; GGC/EE/69-17) Avail: CFSTI CSCL 22/2

A control system is devised to minimize the fuel required to maintain a satellite at the three-body libration point between the earth and moon bodies in the planar very restricted four-body model. The problem is formulated as a linear regulator problem of variational calculus for equations of motion linearized about the libration point. The solution yields a linear feedback control system that is optimal with respect to a quadratic performance criterion. A matrix Riccati equation is solved to obtain the feedback gains. The control system is extended to include the nonlinear system dynamics with the steady-state feedback gains of the linear problem. The performance of the resulting control system is analyzed on a digital computer. Author (TAB)

N70-14999# City Coll. Research Foundation, New York. Dept. of Mechanical Engineering.
THE RESPONSE OF RV STRUCTURES TO IMPULSIVE LOADING Final Report, 15 Sep. 1965 - 31 Dec. 1968
Sherwood B. Menkes 25 Sep. 1969 11 p refs
(Contract DA-31-124-ARO(D)-419)
(AD-695694; CUNY-FR-69-10; AROD-624-S-5-RT) Avail: CFSTI CSCL 16/3

During the period from 15 September 1965 through 31 December 1968, the principal investigator conducted research into the response of RV structures to impulsive loads. Author (TAB)

N70-15057*# Northrop Corp., Huntsville, Ala.
EVALUATION OF ODYSSEY-1 ORBITAL AERODYNAMIC EXPERIMENT PACKAGE
W. P. Walters Jul. 1969 97 p refs
(Contract NAS8-20082)
(NASA-CR-61313; TR-792-8-386) Avail: CFSTI CSCL 22B

An earth orbital aerodynamic experiment designed to improve knowledge of a satellite's interaction with its environment and knowledge of the earth's upper atmosphere is described. This experiment package contains a paddlewheel/diffuse sphere combination, a passive sphere ensemble, a gas-surface interaction experiment, and a mass spectrometer grouping. The mission objectives are to establish the drag coefficients of spherical satellites in a near-free molecular flow, to establish the drag coefficients of flat plates and spheres in a free molecular flow, to investigate the nature of the gas-surface interaction phenomena on engineering surfaces, to determine the atmospheric density, and to determine the atmospheric composition. Additional data will be obtained regarding the influence of the satellite surface on drag coefficient. A discussion of satellite environment induced orbital dynamics and modeling of the earth's atmosphere is discussed. Also, certain other relevant experiments related to the ODYSSEY package are described. Author

N70-15105*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR SURVEYOR MISSION 6, VOLUME 3
N. A. Renzetti 1 Dec. 1969 107 p
(Contract NAS7-100)
(NASA-CR-107535; JPL-TM-33-301-Vol-3) Avail: CFSTI CSCL 22B

This report covers the Tracking and Data System (TDS) activities for Surveyor V, from the time the requirements on the system were established by the project objectives and the spacecraft design, through the preparation of the network support plans, the implementation of the necessary facility configurations, the performance of the requisite tests to establish operational readiness, the support of the actual flights to the end of each mission—with a comprehensive account of the tracking operations, and an evaluation of that support. To better define the requirements on the TDS, the Surveyor Mission objectives are reviewed and descriptions of the Atlas/Centaur launch vehicle and of the spacecraft are included, as is the synopsis of the fifth Surveyor flight. Associated equipment and activities of the three elements of the Deep Space Network in meeting the metric, telemetry, command, and tracking demands of the mission are documented. Technical and statistical data concerning launch, trajectory, operating modes, tracking time, received-signal levels, command lockups, and data transmission and reduction are presented. Author

N70-15106*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR SURVEYOR MISSION 6, VOLUME 4
N. A. Renzetti 1 Dec. 1969 241 p
(Contract NAS7-100)
(NASA-CR-107534; JPL-TM-33-301-Vol-4) Avail: CFSTI CSCL 22B

This report covers the Tracking and Data System (TDS) activities for Surveyor VI, from the time the requirements on the system were established by the project objectives and the spacecraft design, through the preparation of the network-support plans, the implementation of the necessary facility configurations, the performance of the requisite tests to establish operational readiness, the support of the actual flights to the end of each mission—with a comprehensive account of the tracking operations, and an evaluation of that support. To better define the requirements on the TDS, the Surveyor mission objectives are reviewed and descriptions of the Atlas/Centaur launch vehicle and of the spacecraft are included, as is the synopsis of the sixth Surveyor flight. Associated equipment and activities of the three elements of the Deep Space Network in meeting the metric, telemetry, command, and tracking demands of the missions are documented. Technical and statistical data concerning launch, trajectory, operating modes, tracking time, received-signal levels, command lockups, and data transmission and reduction are presented. Author

N70-15137 Texas Univ., Austin.
SUBOPTIMAL ATTITUDE CONTROL OF A SPIN-STABILIZED AXISYMMETRIC SPACECRAFT
Dara Wallie Childs (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-6128

The basic result of this study is the synthesis of a suboptimal feed-back attitude-control system for a spin-stabilized axisymmetric spacecraft. Control torques for this system are generated via body-fixed reaction jets. The control system is suboptimal in the sense that it is approximately fuel-optimal. It is only approximately fuel-optimal because the control torques are assumed to be impulsive as opposed to the finite firing time logic required by the theory of optimal control. The control system synthesized requires two independent measurements of angular errors, but does not require measurement of angular rate errors. Pulse-width modulation is used to generate approximate impulses of varying magnitudes. The system proposed has excellent fuel economy and reasonable response times. The control concept proposed is valid for spacecraft with widely different inertia ratios. Dissert. Abstr.

N70-15188*# McDonnell-Douglas Co., St. Louis, Mo. Eastern Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE SYSTEM. VOLUME 1, BOOK 1: CONFIGURATION DESIGN AND SUBSYSTEMS
Nov. 1969 378 p refs
(Contract NAS9-9204)
(NASA-CR-66863-1; MDC-E0049-VOL-1) Avail: CFSTI CSCL 22B

The configuration analysis, subsystems exclusive of propulsion system, weights and reliability analyses, a definition of the baseline designs, and the propulsion subsystems are included. These are treated separately due to the classified nature of much of the data presented, and because a major portion of the study was directed to the launch propulsion aspects of the configuration. Two special emphasis areas are included: re-entry heating and thermal protection system analysis and integrated avionics. Author

N70-15189*# McDonnell-Douglas Co., St. Louis, Mo. Eastern Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE SYSTEM. VOLUME 4: ONE AND A HALF STAGE CONFIGURATION
Nov. 1969 146 p
(Contract NAS9-9204)
(NASA-CR-66866; MDC-E0049-VOL-4) Avail: CFSTI CSCL 22B

Conceptual design, performance analysis, operations, and the preliminary parametric cost analysis are discussed. Conceptual design results are given for the identification and definition of the candidate concepts, sizing analyses for various payloads, and studies directed toward optimizing vehicle performance and configuration description. Performance analyses include the aerodynamic characteristics for different lengths of 176M vehicles. Swing-nose concept, vehicle-payload integration, and alternate mission are operational modes investigated. Program cost estimates, parametric studies of total program recurring cost, and cost senaitivities are also included. Author

N70-15190*# McDonnell-Douglas Co., St. Louis, Mo. Eastern Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE SYSTEM. VOLUME 3: PROGRAM PLANS AND COSTS
Nov. 1969 198 p
(Contract NAS9-9204)
(NASA-CR-66865; MDC-E0049-VOL-3) Avail: CFSTI CSCL 22B

Program plans are included for design and manufacturing, development test, facilities, launch operations, maintenance and vehicle recovery. Facility requirements show a minimum requirement for new testing facilities and minimum modifications to existing launch facilities. This is based on the assumption that maximum use will be made of existing facilities and that total MDC, government and vendor testing capabilities will be at the disposal of the program. An airline type operational philosophy coupled with the primary objective of reducing operational costs led to maintenance and launch operations plans with a six day turnaround time of which only 24 hours is spent on the pad. The programmatic analysis, based on cost methodology developed from several years of advanced design studies, confirms potential order of magnitude reduction in recurring cost for lofted discretionary payload and total lofted payload. Author

N70-15191*# McDonnell-Douglas Co., St. Louis, Mo. Eastern Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE SYSTEM. VOLUME 2: VEHICLE PERFORMANCE AND OPERATIONS
Nov. 1969 349 p refs
(Contract NAS9-9204)
(NASA-CR-66864; MDC-E0049-VOL-2) Avail: CFSTI CSCL 22B

The aerodynamic and thermodynamic performance of the reusable two stage system for each phase of the baseline mission is considered. Launch, entry and special abort trajectories with associated heating analyses, as well as the hypersonic and subsonic aerodynamic requirements and characteristics are discussed. Also included are the mission analyses, which define the baseline and alternate operational modes and assess the capability of the baseline system to perform alternate missions, and the primary operational analyses which include ground turnaround and cargo handling and crew accommodations. Four special emphasis studies are included, namely, abort, approach and terminal landing, ground turnaround and mission interface and cargo handling/accommodations. Author

N70-15202*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TECHNIQUES FOR SELECTION AND ANALYSIS OF PARACHUTE DEPLOYMENT SYSTEMS
Earle K. Huckins, III Washington Jan. 1970 33 p refs
(NASA-TN-D-5819) Avail: CFSTI CSCL 01A

Parachute deployment systems based on forced ejection, extraction using a drogue parachute, and extraction using a rocket motor were studied. Equations which approximate the linear dynamics of deployment prior to inflation were derived. An expression for approximating the suspension-line tension was developed. A theoretical model describing the resistance of the packed parachute to unfurling was formulated. In a general manner, the problems associated with each of the basic types of deployment techniques were identified and compared. Author

N70-16212*# McDonnell-Douglas Co., St. Louis, Mo. Eastern Div.
INTEGRAL LAUNCH AND REENTRY VEHICLE SYSTEM Executive Summary
Nov. 1969 24 p
(Contract NAS9-9204)
(NASA-CR-66862; MDC-E0049) Avail: CFSTI CSCL 22B

A two stage to orbit reusable spacecraft system for use in transporting cargo and passengers to and from a near earth orbital space station was studied. The overall design goal was to configure the carrier and orbiter vehicles to minimize operational and program recurring costs. This goal was achieved through high system reliability, vehicle recoverability, and rapid ground turnaround capability made possible through modular replaceable component design and use of an integrated onboard self test and checkout system. Launch and land landing of both stages at the ETR launch site was a study groundrule as was the nominal 25,000 lb payload delivered to and returned from orbit. The resulting system has a gross lift-off weight of 3.4 million pounds. The orbiter is a 107 ft HL-10 configuration, modified slightly in the base area to accommodate the two boost engines. The launch propellant tanks are integral with the primary body structure. The carrier is a 195 ft clipped delta configuration with ten launch engines identical to those of the orbiter. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-14136*# General Dynamics Corp., San Diego, Calif.
MANUAL FOR STRUCTURAL STABILITY ANALYSIS OF SANDWICH PLATES AND SHELLS
R. T. Collins, G. W. Smith, and E. E. Spier Washington NASA Dec. 1969 387 p refs
(Contract NAS9-8244)
(NASA-CR-1457) Avail: CFSTI CSCL 20K

Practical methods for analyzing the structural stability of sandwich plates and shells for typical loading conditions which might be encountered in aerospace applications have been compiled. The data covers recommended design equations and curves for a wide range of structural configurations and loading conditions, including combined loads. In a number of cases, actual test data points are included on the design curves to substantiate the recommendations made. For those items where little or no test data exists the basic analytical approach is presented along with the notation that this represented the best available data and should be used with some caution and judgment until substantiated by test. Author

N70-14151# California Univ., San Diego. Dept. of Aerospace and Mechanical Engineering Sci.
OPTIMAL DESIGN OF ELASTIC CIRCULAR SANDWICH BEAMS FOR MINIMUM COMPLIANCE
N. C. Huang and C. Y. Sheu Aug. 1969 39 p refs
(Grant AF-AFOSR-1226-67)
(AD-695048; AFOSR-69-2136TR; TR-15) Avail: CFSTI CSCL 13/13

Elastic circular sandwich beams are designed for minimum compliance and given total weight. To treat the problem in a more realistic manner, the beams are regarded as extensible. Examples are given for the optimal design of circular rings and semicircular arches with different end conditions. The calculated optimal compliance is compared with the corresponding compliance of a uniform beam with identical weight. Finally, the optimal design with stress bounds is also investigated for the ring problem. Author (TAB)

N70-14153*# Southwest Research Inst., San Antonio, Tex.
STUDIES OF INTERFACE DAMPING Final Report, 25 Nov. 1966 – 10 Sep. 1969
U. S. Lindholm and L. M. Yeakley Oct. 1969 40 p refs
(Contract NAS5-10310)
(NASA-CR-107350) Avail: CFSTI CSCL 20K

The energy dissipation and damping characteristics of aluminum cantilever beams having an interface at which slip is allowed to occur are studied. Theoretical solutions for slip in cantilever beams previously available are extended to beams with either nonsymmetric or multiple interfaces. An approximate solution is obtained in which the effects of distributed inertia forces are included. From forced vibration experiments on beams in air at 1 atmosphere and in vacuum, it is found that the effective coefficient of friction is greater in vacuum. The effect of this increase in friction coefficient on damping, as measured by the loss coefficient is found to depend upon the vibration amplitude as well as other system parameters. Supplementary slip experiments with copper show a large increase in friction coefficient in vacuum over that obtained in air. Author

N70-14155*# Southwest Research Inst., San Antonio, Tex.
STUDIES OF INTERFACE DAMPING Summary Technical Report, 25 Aug. 1967 – 25 Mar. 1968
U. S. Lindholm, R. D. Brown, and L. M. Yeakley Jul. 1968 79 p refs
(Contract NAS5-10310)
(NASA-CR-96401; STR-1) Avail: CFSTI CSCL 20K

For structures intended for operation in space, total structural damping may be adversely affected by the vacuum conditions. Since energy dissipation due to slip at structural interfaces is expected to be a major contributor to the overall damping, experiments were performed in air and vacuum on small, nominally flat aluminum specimens in oscillatory sliding contact. Energy dissipation per cycle was measured for both small (microslip) and relatively large (gross slip) tangential displacements. The significant differences which could be found between tests in air and in vacuum are discussed in terms of the retention or loss of the surface oxide layer in aluminum, and the mechanical affects caused by its breakup within the interface. The results with small specimens suggest that interface damping in structures can be significantly reduced in a vacuum or in the absence of oxygen. Author

N70-14160# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
DETERMINING AN APPROXIMATE CONSTANT FAILURE RATE FOR A SYSTEM WHOSE COMPONENTS HAVE CONSTANT FAILURE RATES
J. D. Esary, A. M. Marshall, and F. Proschan Sep. 1969 20 p refs Presented at NATO Reliability Conf., Turin, 1969 *Its* Math. Note No. 617-A
(AD-695122; DI-82-0698) Avail: CFSTI CSCL 13/13

It is often necessary to predict the reliability of a system when only the mean lifetimes of its components are known. Questions arise as to when such procedure is precise, and if it is not precise, what constant values for the system failure rate give reasonable approximations for the actual system failure rate function. These questions are answered in the case that components (a) fail independently and (b) have constant failure rates. Author (TAB)

N70-14162# National Aerospace Lab., Tokyo (Japan).
ON THE VIBRATION OF AXIAL-FLOW TURBOMACHINE BLADES
Toshio Miyachi, Shoji Hoshiya, Yasushi Sofue, Saburo Amihoshi, Tadasuke Iwabu et al Jul. 1969 27 p refs In JAPANESE; ENGLISH summary
(NAL-TR-176) Avail: CFSTI

Calculations of natural frequencies, mode and vibratory stress distributions of axial flow turbomachine blades considering several root conditions, shear deflection and rotary inertia of the blade, and the effect of centrifugal force on the bending and torsional vibration are carried out by the transfer matrix method. Calculated results of the natural frequency of a low aspect ratio turbine blade and a high aspect ratio compressor blade show that the root condition, shear deflection and rotary inertia of the blade have considerable effect on the natural frequencies. Theoretical results also show that large changes appear in the lower mode natural bending frequencies and vibratory stress distributions of the high aspect ratio compressor blade. However the effect of centrifugal force on the natural torsional frequency is not so significant as on the natural bending frequency. For most cases, including the pin-fixed rotor blade, theoretical values of natural frequency agree well with experimental values when proper root condition, shear deflection and rotary inertia of the blade are taken into the calculation. Author

N70-14200# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF MINIMUM-WEIGHT CYLINDRICAL CASED TANKS
V. M. Ryabchenko 8 Apr. 1969 13 p refs Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota (USSR), no. 8, 1966 p 81–86
(AD-695402; FTD-HT-23-1274-68) Avail: CFSTI CSCL 13/4

The desired system is a cylindrical shell of desired length and radius reinforced by equally spaced annular ribs and having spherical ends. It is stressed by axial pressure and excess internal pressure. Optimum planning of structures of this type can substantially reduce their weight. The effect of the original bends on the minimum attainable weight for these structures may be considerable (when they are 8 to 10 or more in number). The numerical evaluation of this effect makes it possible to state efficient tolerances for the initial deviations both in the blanks and the assembled structure. The accuracy with which the optimum parameters are determined depends chiefly on the accuracy of the method of calculating the carrying capacity of the reinforced cylindrical shells. TAB

N70-14207# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Techn. Div.
ASYMMETRIC BULGING OF CYLINDRICAL FILMS UNDER CONDITIONS OF THE CREEP
Yu. M. Volchov and Yu. V. Nemirovskii 31 Jan. 1969 10 p refs Transl. into ENGLISH from Mekhanika Tuerdogo Tela, (Russian), no. 4, 1967 p 136–138
(AD-694762; FTD-HT-23-729-68) Avail: CFSTI CSCL 13/13

A study is made of the problem of determining the critical time for non-axisymmetric buckling of cylindrical shells under conditions of a steady creep. The critical time is defined as a time in which the buckling of a shell having an initial imperfection becomes infinite. Under certain assumptions and using a variational principle analogous to Reissners variational theorem in the elasticity theory, the problem of buckling of long cylindrical shells under external pressures and compressive forces is studied. TAB

N70-14213*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CRYOGENIC TANK SUPPORT EVALUATION Final Report
B. R. Bullard 1 Dec. 1969 142 p refs
(Contract NAS3-7979)
(NASA-CR-72546) Avail: CFSTI CSCL 20K

Thermal performance was determined, experimentally, on thermal models simulating six different tank support concepts. These concepts included a thermal disconnect, a heat block (stacked stainless washers), a cooled strut, a filament wound fiberglass strut, a fiberglass cone segment, and a honeycomb segment. Liquid nitrogen and hydrogen were used for cold boundary temperatures and warm boundary temperatures were nominally 440 R and 540 R. The results were used to resvaluate system weights for LH2 and CH4 propellant tanks up to 15 feet in diameter. Author

N70-14233# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
ELASTIC EQUILIBRIUM OF ISOTROPIC PLANE WITH A DOUBLE PERIODICITY
E. I. Grigolyuk and L. A. Filshtinskii 30 Jan. 1969 15 p refs Transl. into ENGLISH from Prikl. Mekhan., (Russian), v. 2, no. 9, 1966 p 1–7
(AD-695393; FTD-HT-23-827-68) Avail: CFSTI CSCL 20/11

The article summarizes the solution of a problem on the elastic equilibrium of an isotropic plane weakened by a double periodic system of two identical circular openings in the case when elastic discs of a foreign material are welded into the openings. The results obtained are used to solve the problem of reducing the double-period grid--disc system to an equivalent solid plane. In addition to the exact ratio specifying the reduction to the elastic parameters of the equivalent solid plane, some compact approximate ratios were also derived. Author (TAB)

N70-14294# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
FRACTURE OF PRESSURE VESSELS
W. J. Langford *In its* Mater. Res. at Chalk River Oct. 1969 p 1–3 (See N70-14293 03-17)
Avail: CFSTI: Atomic Energy of Can., Ltd., Chalk River: $0.50

Burst tests have been performed with pressure tubes in which longitudinal cracks have been simulated by thin slits. Results show that under operating conditions in CANDU reactors gross leakage should give adequate warning before a defect reaches critical size. Author

N70-14352# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DYNAMIC STABILITY OF A ROD OF NONLINEAR ELASTIC MATERIAL
I. A. Danilyak 31 Jan. 1969 11 p refs Transl. into ENGLISH from Sb. Tr., Mosk. Inzh. Stroit. Inst. (Moscow), no. 47, 1965 p 142–149
(AD-695330; FTD-HT-23-692-68) Avail: CFSTI CSCL 13/13

The author considers the dynamic stability of a rod supported by hinges when the connection between the stresses and the strains is taken in a form which provides a good approximation of the real diagrams for small strains. The problem is solved in the geometrically linear formulation. By introducing some simplifications, the author writes the equation of small oscillations of the rod and reduces the problem of dynamic stability to the investigation of the solution of Matheius equation. A graph is given which determines the region of dynamic instability and it is noted that the presence of physical nonlinearity considerably displaces the region of instability. The amplitude of the oscillations is determined by the method of Bubnov in a geometrically nonlinear formulation. The effect of taking geometrical and physical nonlinearity into account is investigated, and it is noted that the effect of the latter is the basic one. TAB

N70-14387# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF LIGHTWEIGHT-CORE SANDWICH PLATES

IN A SUPERSONIC GAS FLOW

E. A. Efremov 5 May 1969 18 p refs Transl. into ENGLISH from Gidroaeromekh. (USSR), no. 6, 1967 p 67–77
(AD-695948; FTD-HT-23-143-69) Avail: CFSTI CSCL 1/3

This work presents formulas derived for aerothermoelasticity in sandwich plates with a light-weight core, sensitive only to shear stresses, suspended in a supersonic flow. It was assumed that the modulus of elasticity, Poissons ratio, and the coefficient of thermal expansion were all functions of temperature. As an example, post-buckling deformations were studied in infinite sandwich plates in a supersonic flow with a uniform temperature distribution throughout the thickness. Three basic problems were formulated and solved. Author (TAB)

N70-14388# Royal Netherlands Aircraft Factories Fokker, Amsterdam. Space Dept.

SINUSOIDAL VIBRATION TESTS ON DEVELOPMENT MODEL OF EXPERIMENT S-126 FOR TD-2 SPACECRAFT

P. C. van der Waal 4 Sep. 1968 24 p
(RV-23) Avail: CFSTI

Sinusoidal vibration tests were executed on the S-126 experiment. Vibration responses were measured and are reported. Severe and unacceptable resonances occured in the vicinity of the photomultipliers. During development tests this problem was as good as solved but not finished because of stopping of TD-2 activities. Author

N70-14526# State Univ. of New York at Buffalo. Div. of Interdisciplinary Studies and Research.

AN EXPERIMENTAL FACILITY FOR TESTING LOADED STRUCTURES IN A HIGH HYDROSTATIC PRESSURE ENVIRONMENT AND AN APPLICATION TO AXIALLY LOADED COLUMNS

Richard P. Shaw and John Sezna Jul. 1969 62 p refs
(Contract Nonr-4449(00))
(AD-694031; Rept-50) Avail: CFSTI CSCL 14/2

The exploration and utilization of the deep ocean for scientific and defense purposes requires the design of structures which must operate in a high hydrostatic pressure environment. In order to examine such designs, deep sea simulation facilities are required in the laboratory. An experimental facility is described for the testing of structures under a combined axial load and hydrostatic pressure load. This facility was used to determine the effects of hydrostatic pressure (up to 6000 psi) on the load carrying capacity of slender metal columns. There appeared to be no significant effect in this case. Author (TAB)

N70-14527# Brown Univ., Providence, R.I. Div. of Engineering.

FINITE ELEMENT ANALYSIS WITH MATERIAL NONLINEARITIES: THEORY AND PRACTICE

Pedro V. Marcal Aug. 1969 40 p refs Presented at the US-Japan Seminar on Matrix Methods of Struct. Anal. and JSSC Symp. on Matrix Methods of Struct. Anal., Tokyo, Aug. 1969
(Contract N00014-67-A-0191)
(AD-693992; TR-3) Avail: CFSTI CSCL 13/13

A survey of finite element analysis with inelastic material behavior is presented. The constitutive relations for creep and elastic-plastic behavior are first reviewed. These are used to form generalized stress-strain relations for plates and shells. The master stiffness equations are then developed for use with either the method of initial strains or the tangent modulus method. Considerations are given to factors affecting the choice of either method. Case studies are used to illustrate the state-of-the-art in inelastic analysis. Author (TAB)

N70-14557# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE OPTIMUM HEIGHT OF STATISTICALLY DETERMINABLE GIRDERS

A. I. Korshunov 3 Apr. 1969 14 p refs Transl. into ENGLISH from Tr. Inst. Aviats. (Kazan), no. 1, 1966 p 82–90
(AD-695349; FTD-HT-23-1204-68) Avail: CFSTI CSCL 13/13

The process of determining the optimal height for statically determinate frames designed for minimum weight is analyzed. The problems of minimum weight and optimal height are correlated. The author demonstrates a design method for a formula which serves as a problem constraint. This constraint can be met for both fixed and variable frame loading conditions. In developing the method, the author also includes the effects of longitudinal bending and other structural restrictions such as the method of joint fastening. It is noted that application of the method does not require detailed design specification. TAB

N70-14607# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

BENDING RESPONSE OF A CANTILEVER CYLINDER TO TURBULENT SHEAR FLOW

K. R. Cooper Aug. 1969 85 p refs Sponsored in part by Natl. Res. Council of Canada, Ottawa
(Contract F33615-68-C-1055)
(AD-694506; UTIAS-TN-139) Avail: CFSTI CSCL 13/13

This report describes a continuation of the work reported in a UTIAS Technical Note by A. C. Campbell and B. Etkin titled The Response of Cylindrical Structure to a Turbulent Flow Field at Subcritical Reynolds Number. Their model, suitably modified, was used for the present analysis. The response of the base bending moment of a slender, vertically-mounted cantilever cylinder to a turbulent flow field with shear was measured for the drag (streamwise) and lift directions, and the drag response was compared to the response calculated for the same flow field by a linear theory. This theory makes use of the method of normal modes, and includes only the effect of random turbulence in the generalized force function. The turbulent field was determined by measurement of the requisite space-time correlations. Agreement between the theoretical predictions and experimental measurements was found to be quite good, especially at lower frequencies. Author (TAB)

N70-14697# California Univ., La Jolla. Dept. of the Aerospace and Mechanical Engineering Sciences.

THERMOELASTIC STABILITY OF A FINITELY DEFORMED SOLID UNDER NONCONSERVATIVE LOADS

S. Nemat-Nasser Sep. 1969 14 p refs
(Contract N00014-67-A-0109-003)
(AD-694490; TR-33) Avail: CFSTI CSCL 13/13

The paper considers local thermoelastic stability of a finitely deformed solid with internal dissipation, under conservative and nonconservative surface tractions. In particular, stability under circulatory forces are discussed in detail. It is shown that, when nonconservative external forces are also present, the usual Pearson-Hill energy criterion for stability must be supplemented by another inequality which stems from the entropy-balance equation. The relation between this inequality, which is trivially satisfied only if the external load is conservative, and Liapanovs stability criterion is discussed. Author (TAB)

N70-14721# Rand Corp., Santa Monica, Calif.

RESPONSE OF AN ELASTIC HALF SPACE TO AN EXPANDING RING OF SURFACE PRESSURE

D. C. Gakenheimer Aug. 1969 59 p refs
(Contract F44620-67-C-0045)
(AD-695443; RM-6095-PR) Avail: CFSTI CSCL 13/13

The paper gives the derivation of an exact solution for the problem of an elastic half space when the surface is excited by an expanding, concentrated ring of pressure. A number of finite-difference codes exist for computer use in the study of ground motions due to surface or near-surface blasts. The use of different codes can result in different solutions to the same physical problem.

such as the effect of ground shock on underground structures. This work contributes to the numerical accuracy of such codes by obtaining an exact solution for a simulated ground-shock problem. A method is developed for obtaining the displacements due to an expanding distributed surface load by superposing ring load solutions. The case of a decaying pressure profile is used as an example. TAB

N70-14749# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BENDING OF A RECTANGULAR ORTHOTROPIC PLATE
V. S. Yekelchik 3 Feb. 1969 8 p refs Transl. into ENGLISH from Fiz.-Khim. i Mekhan. Orientirovannykh Stekloplastikov (Moscow), 1967 p 178–182
(AD-694421; FTD-HT-23-965-68) Avail: CFSTI CSCL 11/9

The bending of a rigid rectangular plate made of a fiber reinforced plastic was analyzed theoretically, assuming the solid was orthotropic. The bending load on the plate was applied uniformly along the ends. A partial differential equation and boundary conditions were given for the elastic deformation occurring in bending. TAB

N70-14814# Franklin Inst., Philadelphia. Research Labs.
A DIGEST AND COMMENTARY ON THE PROCEEDINGS AND RECOMMENDATIONS OF THE WORKING CONFERENCE ON THRAUSTICS Interim Report
Melvin B. Zisfein, Francis W. Cooke, and Gilbert J. London Aug. 1969 83 p ref Conf. held at Philadelphia, 9-13 Dec. 1968
(Contract F44620-68-C-0068)
(AD-694564; FIRL-I-C2231-2; AFOSR-69-2135TR) Avail: CFSTI CSCL 13/13

The report describes the genesis and development of the emerging field of thraustics, the technology of using high performance materials of limited ductility in load bearing, structural applications. The report presents the nine major recommendations of the conference, background material, a history of the thraustics effort, and interpretative discussions of the recommendations. TAB

N70-14823# California Univ., Berkeley.
ACCELERATION WAVES IN ELASTIC-PLASTIC MATERIALS
P. M. Naghdi, M. M. Balaban, and A. E. Green 1969 44 p refs Prepared in cooperation with Oxford Univ. and Hexcel Corp.
(Contract N00014-69-A-0200-1008)
(AD-695960) Avail: CFSTI CSCL 20/11

Acceleration waves in elastic-plastic materials are studied in some detail on the basis of a nonlinear thermodynamical theory of elastic-plastic continua. Attention is confined mainly to non-conducting media, but the developments are, otherwise, general Formulae for wave speeds are derived, fronts of plastic loading and elastic unloading are discussed, and higher order discontinuities are shown to have the same characteristic speeds as those of acceleration waves. An example concerning propagation of plastic waves in a medium undergoing uni-axial motion is included. Author (TAB)

N70-14888# Genisco Tech. Corp., Compton Calif. Genistron Div.
RFI ATTENUATING MATERIALS AND STRUCTURES: AN ANALYSIS AND CONCEPTUAL DESIGN Technical Report, Jan.–Dec. 1968
Robert B. Cowdell, Richard A. Hupp, and James N. O'Leary Sep. 1969 262 p refs
(Contract F33615-68-C-1206)
(AD-695078; TR-10740; AFAPL-TR-69-89) Avail: CFSTI CSCL 13/13

RFI attenuating materials and construction methods for portable and permanent shelters are discussed and found to be inadequate for high levels of attenuation, even though satisfactory performance may be obtained for lower levels of attenuation. Measurement techniques and test fixtures are developed to permit rapid evaluation of shielding effectiveness of about 100 samples of various materials, including base metals, composites, screens and foils. Test results are presented that permit selection of suitable materials for each level of attenuation desired. Representative samples of commercial enclosures are tested for seam integrity, access opening and door leakage, and overall construction methods. Weaknesses of all the standard assembly methods are discussed in detail. Conceptual designs are developed that apply the materials and construction methods defined to each level of attenuation and type of enclosure. Detailed drawings and specifications are presented for each configuration. A comparison is made between each class of enclosure for weight, volume, erection time and cost for each level of attenuation. Discussions are presented of trade-offs and simplications for each attenuation level and type of shelter. Author (TAB)

N70-14894# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
REVIEW OF COUPLE-STRESS THEORY OF ELASTICITY AND ELASTIC THEORY OF FRACTURE MECHANICS Technical Report
Frederick D. Ju and Y. C. Hsu Jun. 1969 99 p refs
(Contract AF-AFOSR-568-67)
(AD-694559; NE-40; AFOSR-69-1903TR) Avail: CFSTI CSCL 20/11

The purpose of the research was to study both the stress intensity and the energy criteria of elastic fractures in order to incorporate the couple-stress effect which is induced by high stress gradient. The high stress gradient will be present whenever there is discontinuity in material geometry or constitution. Initial effort was conducted on a systematic reviewing and evaluation of the couple-stress theory of elasticity and the elastic theory of fracture mechanics. TAB

N70-15027# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
ANALYSIS OF PIECEWISE UNIFORM OVAL RINGS WITH TRANSITION SECTIONS
William L. Brodsky and William P. Vafakos Aug. 1969 49 p refs
(Contract Nonr-839(39))
(AD-694959; Rept-69-32) Avail: CFSTI CSCL 13/13

Investigations of thin-walled, ring-reinforced cylinders, such as are used for submarine hulls have required the analysis of various types of reinforcing rings. In practice, the reinforcing rings are often fabricated from dissimilar segments. In some cases the design constraints for a reinforced cylinder can dictate the use of an oval geometry. As in the case of circular rings, the construction of an oval ring from dissimilar segments gives rise to stress concentrations at the stepwise discontinuities. The present analysis concerns itself with doubly-symmetric oval rings constructed from uniform, dissimilar, circular segments. The effect upon the maximum stresses of the inclusion of various lengths of a smooth transition section between segments is determined. Author (TAB)

N70-15062# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
FREE VIBRATIONS OF FREE-FREE WEB-STIFFENED SANDWICH BEAMS
Youl-Nan Chen, David Raniet, and Joseph Kempner Sep. 1969 63 p refs
(Contract Nonr-839(40)-FBM)
(AD-694960; PIBAL-69-35) Avail: CFSTI CSCL 13/13

Presented herein is an analysis of the free vibrations of free-free, web-stiffened sandwich beams. The mathematical model formulated includes the effect of translatory and rotatory inertia in

each layer of the sandwich, and assumes that the faces may be treated as thin layers in which classical beam theory applies. Shear deformations, however, are permitted in the core, which is treated as a layer of orthotropic material comprised of a series of webs considered as discrete elements, except for the inclusion of an average secondary shear modulus induced by the bending of the faces and the webs. Equations are also developed for the free vibrations of the corresponding homogeneously cored sandwich beams, in order to investigate the effect of smearing-out or averaging a given web-stiffened core. A Galerkin-type procedure is employed to determine the natural frequencies from a variational functional generated by means of Hamiltons principle. For free-free, web-stiffened sandwich beams of constant weight, the results show that smearing-out the web-stiffened core introduces significant error into the natural frequencies only when the mass in the core layer is distributed among a small number of webs. Author (TAB)

N70-15084# Lehigh Univ., Bethlehem, Pa. Inst. of Research.
BEHAVIOR OF AN ELASTIC SPHERICAL SHELL COMPRESSED BETWEEN RIGID PLATES Technical Report, 1 Jun. 1968 – 1 Jun. 1969
Dean P. Updike and Arturs Kalnins 1 Jul. 1969 47 p refs
(Contract N00014-67-A-0370)
(AD-695506; N00014/0003/1; TR-1) Avail: CFSTI CSCL 13/13

The paper presents an analysis of stresses and deflections produced in a thin, complete spherical shell when it is compressed between two parallel rigid plates. The analysis accounts for finite deflections and rotations, but assumes that the material remains linearly elastic throughout the deformation. It is also assumed that the region of the shell which is in contact with the plate remains flat. The deformation state at which the contact region buckles is given. Author (TAB)

N70-15088# Illinois Univ., Urbana. Dept. of Civil Engineering.
AUTOMATIC ANALYZER FOR ITERATIVE DESIGN
Rebii Ertas (Ph.D. Thesis) and Steven J. Fenves Sep. 1969 111 p refs *Its* Structural Res. Ser. No. 352
(Contract Nonr-1834(03))
(AD-694524) Avail: CFSTI CSCL 13/13

The advent of high-speed computers has provided the structural engineer with improved analytical capabilities to cope with the highly complex problem of structural synthesis. The goal of the study is to investigate the possibility of integrating an automatic analyzer into an iterative design process more effectively by: (a) incorporating partial reanalysis techniques into the methods of solution, so that the performance of the current trial design can be determined by utilizing the information gained in the previous cycle of analysis; and (b) providing quantitative data pertaining to the rate of change of the response quantities of the structure due to modifications of various design parameters. TAB

N70-15086# Technische Hochschule Munchen (West Germany). Institut fuer Technische Mechanik.
STOCHASTIC THERMAL STRESSES Final Scientific Report, 1 Nov. 1966 – 30 Apr. 1969
Heinz Parkus 7 May 1969 4 p refs
(Contract F61052-67-C-0015)
(AD-695037; AFOSR-69-2544-TR) Avail: CFSTI CSCL 13/13

The problem of thermal stresses in elastic and viscoelastic bodies exposed to random temperature variations has been studied. Dependence of viscosity on temperature has been taken into account for linear and nonlinear materials. The problem of lifetime and failure has been investigated. A method for optimizing the heating process of a viscoelastic body to a given final uniform temperature has also been developed. TAB

N70-15101 New York Univ., N.Y. School of Engineering and Science.
ELASTIC-PLASTIC BUCKLING OF THIN RECTANGULAR PLATES
Anthony Nicholas Palazotto (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-4573

A numerical procedure is presented for the solution to the elastic-plastic buckling of a thin rectangular plate. The incremental theory of plasticity is used in conjunction with the Von-Mises yield criteria. The complexity of the partial differential equations for both the stress incremental function as well as buckling determination necessitates the use of a numerical scheme. In this case, the finite difference scheme is used. Numerical results are presented for a plate simply-supported acted upon by a uniform edge loading condition as well as a partial edge loading condition. The relationship of the width-thickness ratio to buckling stress is presented. The magnitude of the incremental load and its effect on the buckling load as well as the stress distribution is considered. Dissert. Abstr.

N70-15107 Northwestern Univ., Evanston, Ill.
EDGE DISLOCATIONS IN A TWO-PHASE MATERIAL WITH INTERFACE CRACKS
Adoorvalappil Cherinhandi Gangadharan (Ph.D. Thesis) 1968 9 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-6925

This work investigates the behavior of an edge dislocation in two phase composite media containing cracks. The regions considered are, two jointed half planes and an infinite plane with a circular inclusion, both having cracks at the interface. Idealization to plane problems is made, and the solutions are obtained using functions of a complex variable. The analysis is done in two major steps. First, the solutions are found for the composite medium without cracks. Next the solutions are supplemented by additional functions to create traction free conditions on the two surfaces of the crack. Both of these constituent problems are reduced to the Hilbert problem or the problem of linear relationship. In the case of perfect bond and no cracks, the Hilbert formulation brings out a general relationship existing between the functions describing the solutions for the two regions of a composite body. Using this relationship, the perfect bond solutions are obtained in a very simple way. The solutions of the crack problems are obtained using the Hilbert formulation. Dissert. Abstr.

N70-15136 Pennsylvania State Univ., University Park.
SOME BASIC PROBLEMS IN VISCOPLASTICITY
Yu-Tsai Chen (Ph.D. Thesis) 1968 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-5536

Attempts are made to establish extremum principles for the theory of viscoplasticity. The basic idea of these extremum principles is that a class of functions can be defined in terms of states of stresses or strain rates. The maximum principles of stress fields and the minimum principles of velocity fields in the mechanics of viscoplastic bodies are established. Also studied is a problem of simply supported circular plate subjected to a rotationally symmetrical load, problem of simply supported circular plate subjected to a concentrated force at the center of the plate, the expansion of a spherical vessel made of rigid-viscoplastic material and subjected to a constant internal pressure, and a thick-walled cylinder made of viscoelastic-viscoplastic material and subjected to a constant pressure. In these last two examples, stress distributions and velocity fields explicitly are functions of time. Dissert. Abstr.

N70-15139 Texas A&M Univ., College Station.
ANALYSIS OF TAPERED THREADED THICK WALLED TUBING CONNECTIONS
Peter Douglas Weiner (Ph.D. Thesis) 1968 119 p

Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-8516

The development of a reliable means of predicting the stresses imposed on a tapered threaded connection during makeup is discussed. Extensive testing which included strain gage, makeup, and leakage tests show that in order to obtain optimum performance from a connection, it needs to be made up to both a minimum number of turns and a minimum amount of torque. The turns being obtained using the criteria that the connection acts the same as a smooth tapered connection and that for maximum leak resistance, the end of the pin needs to be on the verge of yielding. Dissert. Abstr.

N70-15150 Alabama Univ., University.

A THREE-DIMENSIONAL PHOTOELASTIC STUDY OF CONTACT STRESSES BETWEEN CROSSED PRISMATIC RODS

Thomas Charlton Evans, Jr. (Ph.D. Thesis) 1968 95 p

Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-6539

The stresses existing near the point of contact between two identical prismatic rods crossed at a selected angle and loaded transverse to their longitudinal axes were determined. These experimental stresses were compared with those predicted by Hertz theory. Rods of circular and elliptical cross section were used to simulate the crossed configuration of wires in a loaded wire rope. The frozen stress technique of three-dimensional photoelasticity and numerical integration of the differential equations of equilibrium were used to determine the normal and shearing stresses on an axis extending from the contact surface to the center of the rods. Close agreement was found between experimental and theoretical stress distributions for circular cylinders and ellipses having major to minor axis ratios of 1.28. Close agreement between experiment and theory was found only for the maximum normal stress at the contact surface in ellipses having axis ratios of 1.64. Dissert. Abstr.

N70-15183# Army Foreign Science and Technology Center, Washington, D.C.

ACTION OF SHEET CHARGE EXPLOSIVE ON METAL PLATES

A. P. Rybakov et al 22 Sep. 1969 8 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), v. 4, no. 1, 1968 p 126 – 128

(AD-695734; FSTC-HT-23-549-69) Avail: CFSTI CSCL 19/1

Fragmentation phenomena as a result of the action of sheet explosive charges on metal plates is studied. A table is provided which shows the thickness of explosive used, type of plates, fragments formed and fragment velocity. Critical bursting stresses for steel, aluminum and copper are examined, and shock wave attenuation for various metals is shown graphically. Author (TAB)

N70-15197 Vanderbilt Univ., Nashville, Tenn.

FACE WRINKLING OF SANDWICH PLATES AND CYLINDERS

Yau-Cheung Wong (Ph.D. Thesis) 1968 68 p

Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-4654

The investigation is limited to sandwich plates and sandwich cylinders. The problem of face wrinkling is treated as one of local stability of a face sheet resting on an elastic foundation. The core is replaced by an equivalent spring where an energy method is used in the analysis. Formulae are derived and curves are drawn to illustrate the behavior of the structure. The study shows that the plate action does increase the strength of the structure. The effect of the curvature of the cylinder is negligible when the radius is large. Therefore a cylinder can be treated as a plate with width equal to the perimeter. Dissert. Abstr.

N70-15207*# Utah Univ., Salt Lake City. Coll. of Engineering.

COHESIVE AND ADHESIVE POLYMER FRACTURE INVESTIGATION

William Benjamin Jones, Jr. (Ph.D. Thesis) Nov. 1969 115 p refs

(Grant NGR-45-003-029)

(NASA-CR-107561; UTEC-DO-69-150) Avail: CFSTI CSCL 20K

Previous investigators have demonstrated the similarities of cohesive and adhesive fracture through continuum mechanical energy approaches. These approaches have been applied to viscoelastic cohesive fatigue fracture problems and to elastic adhesive fracture analyses. Experimental results graphically illustrate the need for thermomechanical coupling considerations in viscoelastic fatigue fracture predictions. An adhesive fracture test method was developed that verified the analytical predictions and also has engineering applications for evaluation of bond strengths. Some applications are demonstrated by examples of a solid rocket motor and a filament withdrawn from a surrounding matrix. Author

N70-15216*# Cincinnati Univ., Ohio.

VIBRATION CHARACTERISTICS OF A CYLINDER PARTIALLY FILLED WITH LIQUID WITH AN ATTACHED ELASTIC DRAIN PIPE

Robert J. Kroll and Gerard G. Venture Washington NASA Jan. 1970 49 p refs

(Grant NGR-36-004-013)

(NASA-CR-1490) Avail: CFSTI CSCL 20K

The unforced frequencies and mode shapes for the longitudinal vibrations of an elastic-fluid-gas system are determined. This system simulates a fuel tank and drain pipe subsystem of a liquid fueled launch vehicle including the effects of the liquid and ullage gas. A Rayleigh – Lagrange solution was developed and a computer program was written for the analysis of the system having any dimensions and physical properties. Frequencies and mode shapes can be found for all liquid heights. The effect of fuel consumption can be simulated. Axisymmetric breathing of the structure and the flexibility of the tank bottom were found to strongly influence the system response. The ullage gas had only a small effect and asymmetric breathing had no effect on the longitudinal system response. Good correlation was obtained between experimental frequencies determined on several system configurations and those calculated by the method developed herein. Author

N70-15504# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.

THE DYNAMIC PLASTIC RESPONSE OF ALUMINUM TO PLANE STRAIN CYLINDRICAL STRESS WAVES

Ian M. Fyfe and Robert P. Swift Jul. 1969 85 p refs

(Grant DA-ARO(D)-31-124-G780)

(AD-695703; AROD-6226-1-E) Avail: CFSTI CSCL 20/12

The dynamic plastic behavior of hollow cylinders deformed radially by an exploding wire technique is used to consider the relative merits of possible constitutive equations. The experiments are of two distinct types, a finite-rise pressure pulse form of loading and a higher stress level impact test. An analytic study of these tests using in turn a linear elastic, a perfectly plastic incremental, and an elastic/viscoplastic constitutive model provided the means of comparison. The results for 1100-0 aluminum show that only the elastic/viscoplastic model, in which the plastic strain rate component is based on an activation energy dislocation concept, can satisfy the requirement of both sets of tests. Author (TAB)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-14116# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF HEAT LOSS AND HYDRAULIC RESISTANCE OF LONGITUDINALLY FINNED SURFACES
E. S. Kurylev, A. M. Ramadan, and V. S. Enreinova 30 Jan. 1969 13 p refs Transl. into ENGLISH from Kholodilnaya Tekhnika, (Russian), v. 44, no. 9, 1967 p 38–42
(AD-695316; FTD-HT-23-764-68) Avail: CFSTI CSCL 13/1

Heat exchangers with long lengthwise ribs are in practical use. The literature, however, contains no data on the effect of the size of breaks between ribs on the turbulization of flow and reduction of the thickness of the boundary, and consequently also on the size of the heat transfer coefficient. These problems are the object of the present study. At the same time the effect of the breaks between the ribs along the channel on the aerodynamic drag of the equipment was studied. Several versions of longitudinally ribbed surfaces were studied, but in all the rib thickness was 0.2 mm, height 30 mm, and spacing 3 mm. The unbroken ribs were the control; the broken and slanted ribs were the experimental objects. A specially designed setup was used for the study and the following parameters were measured: drop in pressure head of air through windbox, air temperature at inlet and outlet of heat exchanger, air temperature before diaphragm in device, air temperature within windbox and ribbed surface at three positions (rib base, middle rub, and rib top) temperature of rib surface at the same three points, water temperature at inlet and outlet of water box, water consumption. It was found that for ribs, the ratio of whose channel length to equivalent diameter was greater than or equalled seven, the optimum break between rows of ribs over the length of the channel was 3–4 mm. Increasing the break had practically no effect on degree of heat transfer and hydraulic drag. In order to reduce the dimensions of the heat exchanger the break may be reduced, but then the rows of ribs interrupted by the breaks must be alternately perpendicular and at an angle to the base. Author (TAB)

N70-14131*# Battelle Memorial Inst., Columbus, Ohio.
THERMOPHYSICAL AND CHEMICAL CHARACTERIZATION OF CHARRING ABLATIVE MATERIALS Final Report
J. F. Lagedrost, T. J. Fabish, E. A. Eldridge, H. W. Deem, H. H. Krause et al 31 Dec. 1968 92 p refs
(Contract NAS7-342)
(NASA-CR-73399) Avail: CFSTI CSCL 20M

Thermophysical property measurements were made on anhydride cured epoxy novolac, polybenzimidazole, phenolic–novolac nylon, and charred phenolic nylon materials. These materials were measured in virgin or preformed char conditions. Most of the materials measured were composites containing density lowering components such as chopped glass (silica) fibers and glass microballoons. Properties measured comprised thermal conductivity, enthalpy, and expansion. From these properties, specific heat, thermal diffusivity, and density were calculated. Some pyrolysis studies were made preliminary to the thermophysical property measurements to facilitate proper handling of the specimens and to assist in the interpretation and evaluation of the measurements. Thermal conductivities were measured in argon, helium, and vacuum atmospheres. The conductivities of materials with porous phases permeable to gas, such as the polybenzimidazoles and phenolic–novolac nylons, were influenced significantly by the gas in which the specimens were measured. A study of pore structure on conductivity showed a quantitative agreement of total porosity with conductivity. Author

N70-14147# Oklahoma Univ. Research Inst., Norman.
THERMODYNAMICS OF CONTINUOUS SYSTEMS Final Report
C. M. Sliepcevich, K. E. Starling, and J. A. Havens Aug. 1969 245 p refs Arlington, Va. AFOSR Aug. 1969
(Grant AF-AFOSR-563-66)
(AD-695118; OURI-1533-FR; AFOSR-69-2580TR) Avail: CFSTI CSCL 20/13

The feasibility of a unified approach to transport processes based on classical thermodynamics or thermostatics is examined. The first chapter reviews the concept of discontinuous, uniform systems for analyzing continuous or nonequilibrium systems. A comparison of the microscopic and macroscopic approaches for establishing the existence of the reciprocal relations is also analyzed. The implications of invoking the notion of local equilibrium are demonstrated by simple temperature relaxation processes. Chapters 2, 3, and 4 give detailed derivations of the entropy balance for continuous, fluid systems in which diffusion and chemical reactions take place. Emphasis is given to the well-known transport theory paradox which reveals inconsistencies in the entropy balance obtained from classical mechanics as opposed to classical thermodynamics. Techniques for avoiding these discrepancies are proposed. Author (TAB)

N70-14192# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE USE AND DEVELOPMENT OF A NEW METHOD FOR DETERMINING AND CALCULATING LOCAL RADIATION CHARACTERISTICS
Yu. A. Surinov 31 Jan. 1969 30 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSR, Energ. i Transp. (USSR), no. 2, 1967 p 150–169
(AD-695013; FTD-HT-23-1257-68) Avail: CFSTI CSCL 20/13

A method is described for applying the numerical solution of integral equations of radiation to special problems in radiative heat transfer among four bodies placed in a diathermal medium. The problem consists of solving a finite set of linear inhomogeneous algebraic equations. The solutions are discussed in detail for two types of boundary conditions. (1) The fundamental case temperature given at all n-boundaries; (2) the mixed case temperature given for boundary n1 only, the rest being radiant flux conditions. Both cases are applied to a special problem consisting of four zones in a closed system, three of which are gray bodies and one black. The three parameters evaluated in each case are surface radiation density, spherical radiation vector, and the spatial density of the radiation. Author (TAB)

N70-14243# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STRESSED STATE OF GAS-TURBINE DISKS
E. I. Molchanov et al 21 Apr. 1969 9 p Transl. into ENGLISH from the Russian
(AD-694758; FTD-HT-23-1453-68) Avail: CFSTI CSCL 21/5

A 200 mm profiled turbine disk was studied to determine the effect of heat transfer parameters on stresses. The disk was designed to instanteneously increase the rpm and gas temperature to rated values. The heat transfer coefficient in the flow section was varied, the coolant temperature was 100, 300, and 600 degrees C, and the heat transfer coefficient of the end plane was doubled. Depending on the coolant temperatures at the end planes, the temperature distribution with radius can vary for the same temperature gradient. Stress distribution in the disk depends on the shape of the temperature field. Author (TAB)

N70-14246# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
CRITICAL HEAT FLUX UNDER FORCED WATER FLUX
G. V. Alekseev, B. A. Zenkevich, O. L. Peskov, O. V. Remizov, and N. D. Sergeev 3 Feb. 1969 19 p refs Transl. into ENGLISH from Conf. on Tr. Internatsional'Naya Konf. Po Mirovim Ispol'Zovaniyam At. Energii, 3rd., (Geneva), v. 8, 1965 p 295–304
(AD-694825; FTD-HT-23-727-68) Avail: CFSTI CSCL 20/13

Experimental data on boiling burnout under subcooled water and steam-water mixture flows in tubes are examined in relation to data on external, longitudinal flow around a single tube in a symmetric annular gap. The effects of various parameters on the burnout heat flux are considered, and empirical formulas for calculating the burnout heat flux are proposed. TAB

N70-14307# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
DETERMINATION OF THE TYPE OF SPATIAL DISTRIBUTION OF THE ENERGY OF A THERMAL SOURCE WHEN A LASER BEAM ACTS ON STEEL
V. F. Brekhovskikh, A. N. Kokora, and A. A. Uglov 30 Jan. 1969 14 p refs Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov, (Russian), No. 6, 1967 p 3–10
(AD-695390; FTS-HT-23-752-68) Avail: CFSTI CSCL 20/13

The action of a focused laser beam on metals at an intensity not exceeding the critical damage point results in heating and partial melting of the material thus affected. Light radiation is characterized by several controlling parameters, one of them being the distribution of radiation intensity within the hot spot. In the field of materials processing, the absorption coefficient for a given radiation wavelength, temperature-averaged over the metal surface, is of no less interest than the curve showing the time-averaged spatial distribution of radiation intensity. The average integral absorption coefficient for ShKh-15 steel within a temperature range not exceeding the boiling point was found to be 0.54. Maximum surface temperature is attained toward the end of the pulse action and reaches 2040C, thus exceeding the melting point of the steel but staying well below its boiling point. The accuracy of the method suggested by the author does not exceed 15--20%. TAB

N70-14359# Air Force System Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIGITAL COMPUTER STUDY OF HEAT-TRANSFER PHENOMENA IN A MOVING MEDIUM
N. I. Nikitenko 3 Feb. 1969 12 p Transl. into ENGLISH from the book "Konvektivnyi Teploobmen" Kiev, Nauk Dumka, 1965 p 91–104
(AD-695340; FTD-HT-23-855-68) Avail: CFSTI CSCL 20/13

The problem of the unsteady state heat transfer in a flow of liquid leads to the integration of equations in partial derivatives describing this process. The effect is studied of the errors introduced by rounding off in regard to the stability of the solution. The conditions obtained for the stability of the solution are used for programming the solution of the equation for heat transfer on a digital computer. The operational scheme for the program of computations for the heat transfer for stabilized laminar and turbulent flows in a channel of circular section is given, and also examples of calculations for such cases. For the calculations of a plane channel, a different program was required. TAB

N70-14380# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE THERMODYNAMICS OF A CRYSTAL LATTICE
V. A. Moskalenko et al 8 Apr. 1969 18 p refs Transl. into ENGLISH from Teor. i Eksperim. Issled. Fiz. Svoistv Poluprov. Materialov i Drugikh Kristallov (USSR), 1965 p 15–26
(AD-694914; FTD-HT-23-949-68) Avail: CFSTI CSCL 20/2

The paper continues the study of the properties of the basic dynamic characteristics of an anharmonic crystal lattice, which was begun by Marinchuk and Moskalenko, FTT, No. 5, P. 515, 1963; Izvestiya AN MSSR No. 11, 1963. It is planned to publish a study of the anharmonic correction to the thermodynamic potential in low-temperature ranges. Author (TAB)

N70-14385# Air Force Systems Command, Wright-Patterson, AFB, Ohio. Foreign Technology Div.
INTEGRAL METHOD OF CALCULATING THE TEMPERATURE FIELD OF AN AXIAL TURBINE DISK
V. M. Chemin 8 Apr. 1969 13 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Mashinostr. (USSR), no. 1, 1968 p 1–115
(AD-694773; FTD-HT-23-1270-68) Avail: CFSTI CSCL 13/7

A method is proposed for calculating the heat transfer from disk to the air and the specific heat capacity of air assuming that the thermal conductivity of the disk material varies with the radius. One lateral surface of the disk is cooled by air bled from under the deflector, and the opposite surface is cooled by air bled from under the housing. The equation is solved by the successive approximations method. The temperature field was calculated for a turbine wheel having the following parameters: gas temperature before turbine, 935 degrees C; gas temperature at turbine blades, 810 degrees C; gas flow rate, 0.91 kg/sec; air temperature at the disk center, 205 degrees C; total air flow rate, 0.011 kg/sec; revolutions, 38,700 rpm; number of blades, 47 (fir tree-type roots). The temperature field of the disk cooled on one side is shown. Author (TAB)

N70-14394# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MECHANISM OF TURBULENT COMBUSTION
A. M. Klimov 29 Apr. 1969 10 p refs Transl. into ENGLISH from Teoriya i Prakt. Szhiganiya Gaza (Moscow), 1967 p 167–172
(AD-695215; FTD-HT-23-1407-68) Avail: CFSTI CSCL 21/2

With a view toward determining the relative contribution of the fluctuating laminar flame model and of the distributed reaction zone model to the turbulent combustion mechanism of a homogeneous mixture, an analysis has been made of the structure of a liminar flame in a nonuniform hydrodynamic field. In this particular article, the discussion is qualitative and focuses on the physical side of the picture; the main results were reported in an earlier paper by the author (Klimov, A. M., Laminar flame in turbulent flow. PMTF, no. 3, 1963). Starting with the fluctuating laminar flame model, the analysis arrives at a combustion mechanism under large-scale turbulence. The author considers the approach as a first approximation in the quantitative solution of the problem of the turbulent combustion mechanism of a homogeneous mixture. Author (TAB)

N70-14427# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE MECHANISM OF FLAME STABILIZATION ON GAS DYNAMIC SCREENS
V. A. Kosterin et al 27 May 1969 19 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), Spec. Issue 40th Jubilee, 1967 p 114–122
(AD-694925; FTD-MT-24-428-68) Avail: CFSTI CSCL 21/5

The results are presented from an experimental study of the mechanism of flame stabilization in the flow of a uniform combustible mixture on a fan stream, or a combustible mixture which forms a unique gas dynamic barrier in the exhaust stream with the development of a circulatory flow in the wake. The study is focused on the physico-chemical structure of the zone of interaction of the stream with the flow at stages close to and far from the disruption. Based on the analysis of the occurrence of a flame disruption, the authors introduce criteria of flame stabilization which satisfy the generalized limit of stable combustion. The object of the experiments was an axisymmetric flame stabilizer with a

15-mm tube diameter, an aperture width of 0.8 mm, and an outlet stream angle of 135 degrees. The stabilizer was set up at the outlet of a tube 150 mm in diameter, such that the crown was located in the center of the stream. The results of the tests are summarized in the establishment of stability conditions and in an illustrated discussion of the combustion and flow process. Author (TAB)

N70-14625# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES AND METHODS OF FLAME MODELING IN GAS TURBINE COMBUSTION CHAMBERS
N. S. Vinogradov 23 Jun. 1969 18 p refs Transl. into ENGLISH from the book "Teoriya i Praktika Szhiganiya Gaza" Leningrad, Izd-Vo Nedra, 1967 p 215–234
(AD-694779; FTD-MT-24-523-68) Avail: CFSTI CSCL 21/2

The basic conditions for simulating fuel combustion processes and temperature field formation in combustion chambers are reviewed. The schematic shown is recommended for analytical studies of the reaction processes which take place in combustion chambers. Since heat losses are insignificant in combustion chambers operating at high thermal stresses, they can be disregarded in the study of the combustion efficiency of fuel and in the formation of temperature fields. The most reliable modeling can be achieved when the air pressure and temperature at the chamber inlet, the air composition, and the thermophysical properties of the fuel are uniform. The review is based on previous investigations. Author (TAB)

N70-14669*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ZERO-GRAVITY FLAMMABILITY
John Howard Kimzey *In* NASA. Marshall Space Flight Center Space Process. and Manuf. Meeting 21 Oct. 1969 p 323–336 refs (See N70-14651 04-15)
Avail: CFSTI CSCL 20M

A study of flammability in a zero-g environment, based on results obtained during aircraft flight, is discussed. The need for long-duration zero-g testing to study inflight spacecraft fire propagation, safe spacecraft designs, and methods of fire extinguishment is shown. The objectives of Apollo applications program experiment (which concerns flammability in zero g and the equipment needed for the experiment) are discussed. Author

N70-14841*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIATIONAL FORMULATION OF RELATIVISTIC FLUID THERMODYNAMICS
L. A. Schmid Nov. 1969 15 p refs
(NASA-TM-X-63776; X-641-69-511) Avail: CFSTI CSCL 20M

A variational principle is derived for relativistic reversible adiabatic flow of a compressible fluid. This is done by identifying the thermodynamic internal energy function for a given sample of the fluid with its Hamiltonian function, and then invoking the canonical equations of motion. Both in order to bring the rest mass energy into the formalism, as well as to provide a means of labelling and identifying different samples of fluid, it is necessary to introduce a new thermodynamic variable, which is just the molar initial momentum vector of the fluid sample in question. This vector is intimately related to the vorticity of the flow, and if it had been omitted, the formalism would have been implicitly limited to a description of vorticity free flow. Author

N70-14930# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THERMAL STRESSES IN OGIVAL RADOMES WITH TEMPERATURE-DEPENDENT MATERIAL PROPERTIES
Manford B. Tate Jul. 1969 61 p refs
(Contract NOW-62-0604)
(AD-696063; APL-TG-1073) Avail: CFSTI CSCL 17/9

The solution that is developed herein can be used to compute thermal stresses and displacements in the moderately thick walls of appreciably curved ogival shells whose material properties change with heat intensity along the span and through the wall. No restriction is placed on temperature dependent variations of the thermal stress expression. Three examples of the computerized results are presented. The first example deals with a 28.3 in. x 6.75 in. bicentric-ogive radome; the second, with a thick-walled hemispheric radome; and the third, with a thin-walled hemisphere. In these calculations, linear spanwise temperature distributions are used that were obtained from experimental and heat-transfer analyses of a radome tested in a wind tunnel. Through the wall, over specified layers, the thermal-strain function is approximated as being linear with temperature. However, the temperature varies as a third-order nonlinear function through the thickness of the wall as found for the test radome. It appears that errors due to the approximation amount to less than four percent in general. Author (TAB)

N70-15003# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUEL COMBUSTION QUALITY SENSOR
V. S. Kocho et al. 7 May 1969 7 p Transl. into ENGLISH from Russian Patent no. 211004 (Appl. No. 1102598/24-6, 16 Sep. 1968) 3 p
(AD-694183; FTD-HT-23-1426-68) Avail: CFSTI CSCL 21/2

The invention involves a device for determining fuel combustion efficiency. The device consists of a central tube supplying the combustion products to be analyzed; two parallel tubes are connected to the central tube, with Ts supplying a fuel gas to one tube and an oxidizer to the other, and afterburners in each of the two tubes. To increase the rapidity and accuracy of the determination, the afterburners are designed so as to be ionization chambers with electrodes which supply a pulsating high voltage and with an orifice meter at the outlet for measuring the pressure drop. Author (TAB)

N70-15079*# Louisiana State Univ., Baton Rouge. Reacting Fluids Lab.
EVALUATION OF THE ENERGY TRANSFER IN THE CHAR ZONE DURING ABLATION. PART 1: THEORETICAL AND EXPERIMENTAL RESULTS FOR HEAT SHIELD SURFACE TEMPERATURES UP TO 3000 DEG F
Ralph W. Pike, Gary C. April (Ph.D. Thesis), and Eduardo G. del Valle 1 May 1969 599 p refs
(Grant NGR-19-001-016)
(NASA-CR-107533) Avail: CFSTI CSCL 20M

The energy transfer associated with the reacting flow of pyrolysis products through the char layer of a low density nylon-phenolic resin charring ablator was studied experimentally and theoretically. It was found that a nonequilibrium flow model, employing finite reaction rate data for the important reactions among the pyrolysis products, was necessary to accurately describe the energy transport within the char. The important reactions and kinetic data for a temperature range of 500 to 3000 F, with experimental simulation to 2300 F, were determined and incorporated into the mathematical model, called the TEMPRE System. This model, in conjunction with experimental results obtained in a char zone thermal environment simulator, were used to clearly show the shortcomings of the limiting cases of frozen and equilibrium flow in predicting the true behavior within the char layer. Author

N70-15082*# Warner and Swasey Co., Flushing, N.Y. Control Instrument Div.
POSSIBLE TECHNIQUES FOR OPTICAL MEASUREMENT OF TEMPERATURE AND CONCENTRATION PROFILES IN

A SUPERSONIC RAMJET

Burton Krakow, Richard H. Tourin, and Gunter J. Panzias [1969] 54 p refs

(Contract NAS1-5533)

(NASA-CR-66112; W/S-TR-39) Avail: CFSTI CSCL 21B

The requirements and conditions of the ramjet restrict the solution of the measurement problem to a narrower range than would be considered for laboratory applications. The barriers to direct application of existing methods were analyzed, and new variations that may overcome these barriers were devised. The discrepancy between available knowledge and that required by the new methods was evaluated, the research needed to close the gap between them determined, and the effort involved estimated. Spectroscopic instrument technology is available for the optical measurements described. Author

N70-15100 Cincinnati Univ., Ohio.

THERMAL ASPECTS OF GRINDING PROCESSES

Neal Robert Des Ruisseaux (Ph.D. Thesis) 1968 174 p

Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-6335

Some thermal aspects of the grinding process are theoretically analyzed by choosing appropriate thermal models and applying moving heat source theory. Predicted chip shear plane temperatures are related to the temperature reached by the workpiece surface which remains after a grinding pass. It is determined that although very large shear plane temperatures may be calculated, the temperature predicted at the surface of the workpiece is much less than the shear plane temperature. The average temperature which is calculated for the interference zone in a grinding process can contribute significantly to the total temperature of the workpiece surface. The effect of convective surface cooling on temperature distributions is investigated. The models chosen consist of a moving semi-infinite body and a rotating cylindrical body, each with a heat source assumed to act on the surface and convective heat transfer from the surface to an environment is assumed to occur. Dissert. Abstr.

N70-15103*# California Inst. of Tech., Pasadena.

A FLEXIBLE, SIMPLE THERMOSTAT FOR SMALL OBJECTS AND THE TEMPERATURE RANGE OF 100 DEG K TO 400 DEG K

H. R. Bilger and M.-A. Nicolet [1969] 18 p refs

(Grant NGL-05-002-100)

(NASA-CR-107558) Avail: CFSTI CSCL 13A

A flexible, inexpensive thermostat for the temperature range of 100 to 400K is described. Liquid nitrogen is the coolant, and a gas serves as transfer medium. The temperature can be set to better than 1K and is held there within 1/2K by an electronic control system. The relatively small working volume of the order of 10 cu cm allows quick changes of temperature. Author

N70-15149 Arizona State Univ., Tempe.

THERMAL CONTACT RESISTANCE OF METALLIC INTERFACES: AN ANALYTICAL AND EXPERIMENTAL STUDY

Leroy Stevenson Fletcher (Ph.D. Thesis) 1969 207 p

Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 69-5724

A new semi-empirical expression for the prediction of thermal contact resistance between similar metal surfaces in a vacuum environment is developed in terms of known engineering measurements. This expression was formulated from the results of an experimental investigation using aluminum, brass, stainless steel, and magnesium, with a wide range of test variables. The dimensionless parameters for this expression correlated the experimental data and published data within an average overall rms error of 24 percent or less for most of the data. These experimental data included mean junction temperatures of −250 F to 500 F, apparent interface pressures of 10 to 7,000 psi, surface flatness deviations of 15 to 4,500 microinches, and surface roughnesses of 3 to 120 microinches. An expression was also determined for the prediction of the contact area between two similar metal surfaces. Dissert. Abstr.

N70-15168*# Adelberg Research and Development Labs., Sherman Oaks, Calif.

A PHYSICAL MODEL FOR DOWNWARD BURNING

Ernest Mayer and Marvin Adelberg 13 Oct. 1969 35 p refs

(Contract NAS9-8778)

(NASA-CR-102068; TN-310-N-10-69) Avail: CFSTI CSCL 20M

An elementary physical model for the combustion of flammable materials is presented with primary emphasis upon downward burning. The theoretically predicted results are reasonably consistent with available data. The effects of gravity are discussed. A set of system equations required for a more refined model is also presented. Author

N70-15182# Army Foreign Science and Technology Center, Washington, D.C.

PERIOD OF COMBUSTION AND HEAT EXCHANGE IN THE COMBUSTION OF GASEOUS FUEL

A. S. Isserlin et al 23 Sep. 1969 32 p refs Transl. into ENGLISH from the Russian

(AD-695512; FSTC-HT-23-548-69) Avail: CFSTI CSCL 21/2

This is a review of recent Soviet research and development on gas and oil fired burners for industrial boilers, heating systems, and gas turbine engines. Attention is focused on the ignition of gaseous fuel, chiefly natural gas. The chief points of interest are problems of the intensification of combustion processes, heat exchange during ignition of gas fuel, methods for igniting gas fuel, ignition of gas in the combustion chambers of gas turbines, and simulation of ignition processes of gas fuel. TAB

N70-15185# Army Foreign Science and Technology Center, Washington, D.C.

STABILITY OF FLAMES

A. G. Istratov 9 Oct. 1969 67 p refs Transl. into ENGLISH from the Russian

(AD-695726; FSTC-HT-23-952-68) Avail: CFSTI CSCL 21/2

The problem of the stability of flames is connected with the fundamental conception of the theory of burning, a question which occupies a somewhat isolated place in the theory. This position is caused, apparently, because the investigation of stable plain flames has not been complete. A treatment is presented. Author (TAB)

N70-15188 Case Western Reserve Univ., Cleveland, Ohio.

PHASE EQUILIBRIUM STUDIES AND THERMODYNAMIC PROPERTIES OF THE BISMUTH-TELLURIUM SYSTEM

Chung-Chiun Liu (Ph.D. Thesis) 1968 127 p

Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-9419

Bismuth-tellurium alloys, important thermoelectric refrigeration compounds, were investigated by different techniques, namely, electromotive force measurements, coulometric titrations, X-ray diffraction and differential thermal analyses. Thermodynamic properties of the constituents in the alloy were obtained from the experimental results. The considerable discrepancies between the reported phase diagrams of the bismuth-tellurium system were clarified, particularly near the compound Bi_2Te_3. In addition, the magnitude of the bonding energies existing in the alloy and the effect of the electron constitution on the thermodynamic properties of the alloy were qualitatively discussed. Dissert. Abstr.

N70-15209*# Adelberg Research and Development Labs., Sherman Oaks, Calif.
A STUDY OF THE RESULTS OF TESTS INVESTIGATING THE EFFECT OF ACCELERATION AND GAS COMPOSITION ON THE BURNING RATE OF SPACECRAFT MATERIALS
J. Callinan and M. Adelberg 17 Dec. 1969 15 p refs
(Contract NAS9-8778)
(NASA-CR-102069; TN-311-N-12-69) Avail: CFSTI CSCL 20M

Combustion characteristics of thirteen "vertically oriented" nonmetallic spacecraft materials were investigated. Results of an analysis of the burning rate data obtained in the above test program are presented. It was found that the average value of the ratio of the "upward" to "downward" burning rates at 1 "g" was 2.9. Both the "upward" and the "downward" burning rates increased with increasing acceleration, with the "upward" increasing at the greater rate. The "upward" burning rates at 1 "g" were found to depend monotonically on the oxygen partial pressure. The "downward" burning rates appeared to be affected by the presence of the diluent nitrogen. Author

N70-15210*# Adelberg Research and Development Labs., Sherman Oaks, Calif.
A STUDY OF THE RESULTS OF TESTS INVESTIGATING THE EFFECT OF ACCELERATION ON THE BURNING RATE OF SPACECRAFT MATERIALS
J. Callinan and M. Adelberg 12 Aug. 1969 22 p refs
(Contract NAS9-8778)
(NASA-CR-102067; TN-314-N-8-69) Avail: CFSTI CSCL 20M

The effect of acceleration on the "downward" burning of vertically oriented spacecraft materials in a pure oxygen environment is presented. At low acceleration levels free convection tends to cool the fuel material ahead of the flame front, thus decreasing the burning rate. At higher acceleration levels flowing melt and migrating burning particles preheat the fuel material ahead of the flame front, thus increasing the burning rate. The results of tests investigating the effect of acceleration on horizontally oriented cotton specimens, in various environments, indicate that burning rates increase with acceleration level approximately as predicted by a theoretical model. Author

N70-15217*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
A BIBLIOGRAPHY OF THERMOPHYSICAL PROPERTIES OF AIR FROM 0 TO 300 K
L. A. Hall Oct. 1969 124 p refs
(NASA Order R-06-006-046)
(NASA-CR-107578; NBS-TN-383) Avail: SOD $1.25 SD Catalog No. C13.46:383 CSCL 20M

References together with an abbreviated abstract are presented for mechanical, thermodynamic, and transport properties of air from 0 to 300 K published to December 1968. A total of 610 articles have been indexed. Each article has been reviewed and coded with regard to properties studied, type of article (i.e., experimental, theoretical, etc), and method of presentation of data. The temperature and pressure ranges for each property under consideration are also given. An index has been prepared according to property with four subcategories: solid, liquid, gas up to 200 K, and gas above 200 K. Author

N70-15220*# United Aircraft Corp., East Hartford, Conn.
INVESTIGATION OF THE MIXING AND COMBUSTION OF TURBULENT, COMPRESSIBLE FREE JETS
Leonard S. Cohen and Roy N. Guile Washington NASA Dec. 1969 101 p refs Presented at AIAA 5th Propulsion Joint Specialist Conf., Colo., 9–13 Jun. 1969
(Contract NAS1-7255)
(NASA-CR-1473; AIAA-69-538) Avail: CFSTI CSCL 20B

The effect of combustion on the mixing of axisymmetric, supersonic, turbulent free jets was investigated experimentally using cooled probes, an Ebert spectrophotometer, high-speed motion pictures, and schlieren, infrared and ultraviolet photographs. Results of this work including detailed Mach number, temperature, and species concentration profiles are presented for the mixing of a Mach 1.46 central jet of cold hydrogen with a vitiated Mach 1.86 concentric outer jet. The flow conditions in the high temperature vitiated jet flow were adjusted to provide two different values of oxygen concentration in an effort to identify the separate effects of mixing combustion. Static temperatures of the vitiated streams exceeded the H2/O2 autoignition value of 1000 K. Samples aspirated from the flow through quenching probes were analyzed for species concentrations by employing an on-line gas chromatograph. Water concentration and local static temperature were also measured spectrophotometrically for comprison with the probe measurements. A comparison of mixing rates in equivalent combusting and inert jet flows showed little difference for the conditions studied. Author

N70-15390*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS TURBINE FACE SEAL THERMAL DEFORMATION AND COMPUTER PROGRAM FOR CALCULATION OF AXISYMMETRIC TEMPERATURE FIELD
Terrence E. Russell, Gordon P. Allen, Lawrence P. Ludwig, and Robert L. Johnson Washington, D.C. Dec. 1969 111 p refs
(NASA-TN-D-5605; E-4389) Avail: CFSTI CSCL 20M

A computer program, which is general and can be applied to a variety of steady state thermal problems, is presented. The program is written in FORTRAN IV language. Application of the program to a specific mainshaft seal design is illustrated; both computer input and output data are given. A sample problem, having an exact solution, is also given as a means of demonstrating program accuracy. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-14110# National Bureau of Standards, Washington, D.C.
REPORT OF THE 54TH NATIONAL CONFERENCE ON WEIGHTS AND MEASURES
R. L. Koeser, ed. Nov. 1969 272 p refs Conf. held at Washington, D.C., 9–13 Jun. 1969 *Its* Spec. Publ. no. 318
Avail: SOD: $1.50

Conference papers and committee reports are given. Research activities on automobile occupant restraint systems, braking systems, and tires are reviewed. The highlights of the technical accomplishments and the expansion of program activities with respect to weights and measures are indicated. The session on weighing emphasized large capacity scale testing units and the maintenance, use, and calibration of test weights. Methods of inspecting grain moisture meters, taximeters, and rental vehicle odometers are described. Discussions are presented on the merchandising problems of retail sale of beef by hanging weight, produce labeling, and the effect of the Repeal of the Standard Container Acts of 1916 and 1928 on weights and measures enforcement. Inspection of military grocery and merchandizing stores and testing postal scales are mentioned. The development and use of national voluntary standards and the directions taken by the Metric Study group are outlined. The panel on fair packaging and labeling considered the roles of the Food and Drug Administration, the Federal Trade Commission, the Department of Agriculture, and the Internal Revenue Service. N.E.N.

N70-14237# Texas A and M Univ., College Station. Industrial Economics Research Div.
MARINE RESOURCES ACTIVITIES IN TEXAS
Aug. 1969 227 p refs
(Grant NSF CH-26)
(PB-185753) Avail: CFSTI CSCL 05C

Analysis of the 72-county study area indicates that approximately 4.5 million persons reside in the area which comprises 27.1 percent of the state's total land area. Total personal income and employment in the study area account for approximately 41 and 40 percent, respectively, of the personal income and employment in Texas. Total nonfarm construction in the study area increased by 47.8 percent from 1964 to 1968. Over 170 million tons of cargo passed through Texas ports in 1967 and over 60 million tons were transported on the Gulf Intracoastal Waterway. Out of 30 colleges and universities surveyed, 15 schools reported marine related activities for 185 projects with expenditures of $5,357,892. Five non-profit research organizations in Texas expended approximately $787,000 in FY 1968 for marine related research.
Author (USGRDR)

N70-14346*# New Mexico Univ., Albuquerque.
PROGRAM FOR ADVANCED STUDY IN PUBLIC SCIENCE POLICY AND ADMINISTRATION Semiannual Report, Feb. – Sep. 1969
Sep. 1969 84 p
(Grant NGL-32-004-042)
(NASA-CR-107410) Avail: CFSTI CSCL 05A

This report reviews the Program for Advanced Study in Public Science Policy and Administration at the University of New Mexico for the period February 1, 1969 to September 15, 1969. The reporting period included four significant events: 1) two meetings of the Regional Advisory Committee; 2) the National Conference on Public Science Policy and Administration; 3) the formulation and approval of organization and curriculum ; and 4) the selection and arrival of the Fellows in the Program.
R.B.

N70-14369# Northwestern Univ., Evanston, Ill. Dept. of Psychology.
CRITERIA FOR EVALUATING FORECASTS
Thomas W. Milburn May 1969 25 p refs
(Contract N00014-67-A-0356-0004)
(AD-696091; TR-5) Avail: CFSTI CSCL 5/10

Planners find it necessary to make projections of trends or other forecasts of probable events or changes from the present state. Sometimes they must emphasize improbable events relevant to their missions. The growing interest in forecasting suggests a need for principles or criteria for better as contrasted with worse ones. Some criteria are suggested along with an example which appears to be consonant with them.
Author (TAB)

N70-14397*# National Aeronautics and Space Administration. Washington, D.C.
R AND D REPORTING: GUIDANCE FOR TECHNICAL MONITORS OF NASA CONTRACTS
1969 16 p
(NASA-SP-7034) Avail: CFSTI CSCL 05B

Options that monitors may use in directing the preparation and dissemination of NASA research and development reports are cited. Emphasis is placed on contract reporting requirements, documenting technology innovations, and effective utilization of NASA's scientific and technical information system.
J.M.C.

N70-14798*# Syracuse Univ., N.Y.
MULTIDISCIPLINARY STUDIES IN MANAGEMENT AND DEVELOPMENT PROGRAMS IN THE PUBLIC SECTOR: PUBLICATIONS LIST
Martin E. Barzelay Dec. 1969 8 p refs
(Grant NGL-33-022-090)
(NASA-CR-107457) Avail: CFSTI CSCL 05A

A bibliographical listing is presented of working and occasional papers, reports, theses and dissertations, and publications on the role of the project manager, regulations in space, NASA and business community relations, noneconomic criteria for project evaluation, exposition and real time decision making, case studies, and miscellaneous research.
J.A.M.

N70-14848*# Syracuse Univ., N.Y. Graduate School.
THE PROFESSIONAL AND TECHNICAL QUALIFICATIONS OF APOLLO PROJECT MANAGERS
John Phillip Cicero Aug. 1969 151 p refs
(GRANT NGL-33-022-090)
(NASA-CR-107458) Avail: CFSTI CSCL 05A

Some specific criteria which can be identified with project manager as a professional career are formulated. The demographic characteristics of a sample of Apollo project managers are compiled and evaluated in terms of their professional and technical qualifications. Final analysis of the data revealed the following characteristics as predominant project manager career specifications or prerequisites.
Author

N70-14847*# University of Southern Calif., Los Angeles. Management Lab.
MANAGEMENT PROBLEMS: THE RESEARCH AND APPLICATIONS INTERFACE
Milton G. Holmen, Peggy Sanders, Richard P. Nortman, and Allyn R. Franklin 16 Dec. 1969 18 p refs
(Grant NGL-05-018-098)
(NASA-CR-107430) Avail: CFSTI CSCL 05A

The need for research which will help managers bridge the gap between management theory and application of the theory to their real situations is discussed. A number of interaction exercises currently in use to involve managers in significant learning experiences and in feedback processes which help them relate the exercises to their work situations are discussed. Methods are presented by which managers may become aware of the kinds of problems that may exist in their work groups, potential ways to solve these problems, and ways to structure organizations for greater efficiency.
Author

N70-15021# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GENERAL RESEARCH Quarterly Technical Summary, 1 May – 31 Jul. 1969
Frederick C. Frick, Robert H. Kingston, Alan L. Mc Whorter, Herbert G. Weiss, and John F. Hutzenlaub 15 Aug. 1969 45 p
(Contract AF 19(628)-5167)
(AD-694054; ESD-TR-69-210) Avail: CFSTI CSCL 5/2

Activities in the following research areas are summarized: Surveillance techniques; Digital computers; Psychology; Computer systems; Microwave components; Optics and infrared; Mechanical engineering; Control systems; Microelectronics; Solid state devices; Materials; Physics of solids.
TAB

N70-15040# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
Nov. 1969 31 p refs
Avail: CFSTI

CONTENTS:

1. COSMIC RAY NEUTRONS IN THE FIRST SIX METERS BENEATH A WATER SURFACE J. I. Hoover and C. F. Dohne p 1–4 refs (See N70-15041 04-13)

2. OPTICAL THIRD-HARMONIC MEASUREMENTS OF SUBPICOSECOND LIGHT PULSES R. C. Eckardt and C. H. Lee p 5–8 refs (See N70-15042 04-24)

N70-15120*# California Univ., Berkeley. Space Sciences Lab.
THE POLITICS OF LOCAL REVENUE
Arnold J. Meltsner (Ph.D. Thesis) Aug. 1969 381 p refs *Its* Ser. 10, Issue 42
(Grants NGL-05-003-012; NGR-05-003-125)
(NASA-CR-107375) Avail: CFSTI CSCL 05C

Oakland, California's financial crisis is outlined, and its major revenue sources are described. After briefly noting Oakland's social and economic problems, its revenue-expenditure gap and some major revenue trends are discussed. The effect of the city's revenue constraint on the behavior of the city manager, council, and departments, is examined along with the revenue subsystem. The subsystem anticipates expenditure demands and taxpayer reactions. The sewer service charge is examined to illustrate how the subsystem minimizes political costs while incurring economic costs. Two disjunctions in the no-money budgetary process which are directly related to the city's continuous revenue constraint are discussed. Balancing the budget and the use of the budget as a control efficiency device are cited as alternative forms of revenue behavior. Insights into public opinion on taxation and general policy implications for cities in financial distress are reviewed. J.A.M.

N70-15388*# Techtran Corp., Glen Burnie, Md.
TWO WEEKS WITH THE AMERICAN ASTRONAUTS [DVE NEDELI U AMERIKANSKIKH KOSMONAVTOV]
N. Mar Washington NASA Dec. 1969 11 p Transl. into ENGLISH from Literaturnaya Gazeta (USSR), no. 48, 26 Nov. 1969
(Contract NASw-1695)
(NASA-TT-F-12714) Avail: CFSTI CSCL 05I

Extracts are reported from a Soviet press conference with the cosmonauts Beregovoy and Feoktistov held after their two week tour to Houston and other major American cities. Topics discussed include: the status of the American space program, Apollo lunar flights, orbital space stations, Soviet space goals, and international cooperation in space. E.C.

N70-15401*# Denver Research Inst., Colo. Industrial Economics Div.
PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER Quarterly Report, 1 Jul. – 30 Sep. 1969
Dean C. Coddington, James E. Freeman, Eileen R. Staskin, and Barbara A. Stevenson 7 Nov. 1969 213 p refs
(Contract NSR-06-004-063)
(NASA-CR-107562; QR-7) Avail: CFSTI CSCL 05B

The research activities during this period include: (1) telephone results of interviews with requesters for the technological support package (TSP); (2) study of technology transfer within NASA Apollo contractor organizations; (3) study of persons using Gemini and Apollo photographs; and (4) a seminar on technology transfer. Individual technology transfer cases for the TSP program are included. F.O.S.

N70-15403*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-55, VOLUME 3 FOR THE PERIOD 1 DECEMBER 1968 TO 31 JANUARY 1969. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
28 Feb. 1969 271 p refs
(Contract NAS7-100)
(NASA-CR-107569; JPL-SPS-37-55-Vol-3) Avail: CFSTI CSCL 05B

Included are summaries of the research and development in the following areas: systems analysis research, sterilizability evaluation of Geiger-Mueller counter tubes, communications systems research, communications elements research, spacecraft telemetry and command, spacecraft radio, spacecraft telecommunications systems, flight computers and sequencers, spacecraft power, guidance and control analysis spacecraft control, planetary entry heat shields, electronics parts engineering, aerodynamic facilities, solid propellant engineering, polymer research, and liquid propulsion. F.O.S.

N70-15491*# New Mexico Univ., Albuquerque. Technology Application Center.
[ACTIVITIES OF TECHNOLOGY APPLICATION CENTERS] Quarterly Status Report, Jul. – Sep. 1969
Sep. 1969 31 p
(Contract NSR-32-004-049)
(NASA-CR-107560) Avail: CFSTI CSCL 05B

User activity, marketing, and dissemination operations of the natural resources and industrial programs are summarized, along with the economic status and organizational changes at the information center. Steps were taken to provide quality photograph reproductions in reduced turn-around time. The EDN Caravan tour to publicize the technical utilization program is briefly discussed. J.A.M.

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